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QUEENSLAND AGRICULTURAL JOURNAL

VOL. XXVII. 1 FEBRUARY, 1927. PART 2.

Event and Comment.

The Risk of Bunchy Top—Warning to Banana-growers.

As the weather conditions are now very favourable for the development and spread of Bunchy Top, every banana-grower in that part of the Southern portion of this State in which this disease has been found, as well as those in the districts adjacent thereto, is hereby warned that unless he keeps his plantation under constant supervision in order to detect the first trace of Bunchy Top, so that the immediate destruction of every affected stool may be carried out promptly, there is every probability of the disease obtaining a firm hold in any such plantation. On the other hand, if the recommendations of the Bunchy Top Control Committee are carried out to the letter, there is no reason why the further spread of this very serious disease should not be controlled. Bunchy Top can only be spread from an affected stool by means of the Black Banana Aphis, which has fed on such stool, and if no affected stools are permitted to remain in the plantation there is no source from which these insects may transfer the virus, which is the immediate cause of the disease. Unfortunately, despite all the advice that has been given to growers, a few evidently do not realise the seriousness of the position, and orders have already had to be issued for the immediate destruction of infested plants in several plantations. Growers need not become unduly alarmed, however, for there are several instances where the committee's recommendations had been carried out to the letter in which the disease is absolutely under control.

"Ignorant Cockies."

In the course of the proceedings at a recent meeting of a public body just across the Border, one speaker referred rather contemptuously to some district farmers as "ignorant cockies." This expression called forth many indignant protests from farmers, who resented keenly the ill-mannered remark; but, while the indignation is natural, are not farmers themselves often to blame for depreciatory references to

themselves and their industry—blameable to the extent of accepting such derogatory appellations continually without protest? In fact, is it not quite common at country meetings for farmers to call themselves "cockies" and describe their own vocation as "cockying"? Even in Press communications many a good letter is spoilt by the pen-name adopted in a spirit of flippancy by the writer—"Cow Cocky," "Cane Cocky," "Poddy Dodger," and similar self-depreciatory pseudonyms. The world too often takes us at our own valuation, and self-depreciation never gets us anywhere.

In his contact with the world in general, in his contribution to the wellbeing of humanity, in his share in commercial and industrial enterprise, in his place in the realms of literary, artistic, and scientific achievement, and as a citizen of the Commonwealth, there is no warrant for the Australian placing himself under the influence of or developing what is called, in the psychological jargon of the day, an inferiority complex. Australians have demonstrated their character and capacity in every field of human endeavour, both in peace and in war; they have shown themselves in no way inferior to other peoples either in intelligence or attainment. On the contrary, possessing as they do all the positive characteristics of the composite British peoples, the elements of the Australian race, they have many points decidedly in their favour—and that may be said without overweening conceit and only on the evidence of the facts. While all this may be fairly claimed of Australians in general, the same may be said of farmers, as a class, in particular. When leaders were wanted in the A.I.F., boys from the Bush supplied the demand. When the Australian Air Force came into being, the service that called for the highest degree of daring, courage, resource, and enterprise was manned largely by lads from the farm and the station. The man who organised the transport services of the greatest mounted force the world has known—the Australian Light Horse and its co-operating Imperial units in Palestine—and won the expressed recognition of the nation, is a Queensland farmer. In the field of invention and in every avenue of peaceful enterprise, urban or rural, the land has supplied more than a fair share of the brains and brawn that established great undertakings, backed them, and led or forced them through to complete success.

The thoughtless gibe which we have taken as our text would naturally rankle in the minds of those to whom the epithet was applied, but again it is asked are not farmers in some measure themselves responsible? What real protest have they ever made against the continual caricaturing of themselves in cheap city prints by artists whose conception of the farmer—the national food provider and economic shock absorber—is of the "Dad and Dave" order? Why do they call themselves, or allow themselves to be called, "cockies"? In the last generation the stage "Irishman" was an inhabitant of every music hall—a standing insult to a great race of people. Through vigorous objection that grotesque travesty was banished from places of amusement never to return. Why do farmers endure without effective protest, even though some of their number unconsciously or thoughtlessly encourage it, the continual, humiliating caricaturing of themselves and their calling—one of the greatest and noblest to which man may set his hand and brain.

Scientific Research—Its Influence on Agriculture.

"Remarkable interest is being shown in all parts of the world in agricultural research—not only for the sake of research to contribute new knowledge, but for the practical application which research has in increasing production. Java has the best organised and most utilitarian agricultural research station in the world. South Africa has accomplished wonders in stamping out stock diseases, and the breeding of special wheat has increased the Canadian yield by over 20,000,000 bushels a year. A group of Scottish farmers have contributed £23,000 towards the cost of maintaining a plant-breeding station near Edinburgh, and farmers in North Ireland have contributed £80,000 towards the endowment of an agricultural research station near Belfast." Thus Professor A. E. V. Richardson, the South Australian, who holds the Chair of Agriculture at the University of Adelaide, in the course of an interview with the Brisbane Press on his way home from a world tour of inquiry. He also said the main object of his visit was to investigate the progress of agricultural research and agricultural education in those countries he visited. Generally, in all the countries he visited, there had been a great increase in the interest displayed in agricultural education and research. It was particularly noticeable in Great Britain, South Africa, the United States of America, and Japan. Java had always been wonderfully organised from the point of view of agricultural research.

"The great lesson we have to learn," he continued, "is the value placed on agricultural research in other countries, and the great increase in production that has been brought about by systematic organisation. Enormous progress has been made in the wheat industry in Canada by the breeding and production of a new variety of wheat. The Marquis wheat—a production of Dr. Saunders—has displaced all other

varieties in Canada, and is spreading to the wheat-growing regions of the United States. It is estimated that the production of this new variety has increased the annual yield by over 20,000,000 bushels. In Sweden the production of a new variety of wheat that is prolific, hardy, and early maturing has led to the trebling of production during the past twenty years, owing to the wheat belt being pushed further north by the production of the new variety. Similar developments in the realm of plant-breeding have been shown in the enormous increase in the rice crops of Japan, which now exceeds 340,000,000 bushels—nearly twice the Australian wheat crop. Sir Rowland Biffen, of Cambridge University, has been successful in producing a prolific variety of wheat of high milling quality, and this is rapidly superseding the older varieties, particularly in the eastern half of England."

The immense practical work in agricultural research in Java impressed Professor Richardson particularly.

Professor Richardson, continuing, said that the British Government had made substantial contributions to the Dairy Research Institute at Reading University, and as the result of recent researches there had been a great improvement in the milk supply to the city, and a considerable increase in the production of dairy farms.

In South Africa the losses of cattle, sheep, and horses through sickness had formerly been enormous, but during recent years the losses had been almost entirely eliminated through the investigational and agricultural work of the Veterinary Research Institute near Pretoria. It was estimated that the monetary value of the Research Institute, under Sir Arnold Theiler, in reducing stock disease had paid the whole cost of agricultural research and education in South Africa since the inception of the Union Government sixteen years ago.

The Work of the Departmental Economic Committee.

The Departmental Economic Committee appointed recently by the Minister for Agriculture and Stock, Hon. W. Forgan Smith, has already entered upon its work. At its inaugural meeting on 18th January the chairman, Mr. E. Graham (Under Secretary, Department of Agriculture and Stock), suggested the scope of its survey in the course of his opening address. A need, he said, for a general inquiry into the basic factors of land settlement, agricultural production, and marketing system existed, and it would be the business of the committee to make that inquiry. Farmers, both collectively and individually, and all those connected with the agricultural industry were concerned with its present economic position. Farmers themselves had not been loth to recognise that position which was not entirely satisfactory. There was room for improvement in methods and in other directions, and the taking of what might be called an economic survey was a task which confronted the committee. Farmers were not altogether responsible for the unsatisfactory state of their industry. Economic factors were often against them, and in efforts to solve the problems created by those factors it was felt that such a committee would be of great assistance.

Exact knowledge was required to be placed at the disposal of farmers and settlers in respect to crops, acreages, stock-carrying capacity, suitable areas for the different classes of husbandry, and so forth.

The committee might give some consideration to the general difficulties of the industry—collect data on which definite conclusions could be based. It might also classify the several forms of farming into groups, and consider everything relating economically to each group, and place itself in a position of being able to give directive and advisory service to those engaged or about to engage in land pursuits.

There was need for representation of the Lands Department on such a committee so that there would be complete understanding and co-ordination between officers of the two departments concerned in the welfare of agriculture. The size of farming areas and land classification might, for instance, be subjects for mutual consideration and exchange of opinion.

It was felt that what was required were intelligent direction and economic harmony in the agricultural industry.

The committee would also be in the position of giving sound advisory service to the farmer on the economics of his industry, in relation particularly to the varying production cost factors in different districts, the advisability or otherwise of adjusting production to demand in respect to certain of his crops, and primary factors affecting crop cultivation, areas to be cropped, cycles of over and under production, and cycles of high and low demand in relation to certain crops.

For its first subject of inquiry the committee decided to take the dairying industry, the present economic of which is now under review.

Bureau of Sugar Experiment Stations.

CANE PESTS AND DISEASES.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has made available the following report (23rd December, 1926) from the officer investigating cane diseases (Mr. N. L. Kelly):—

Bundaberg and Maryborough.

The condition of the Bundaberg canefields due to drought, just before the recent rains, and disease, is not promising. A comprehensive scheme of irrigation is worthy of serious consideration in minimising the harmful effects of the frequently recurring dry seasons. Good cultivation, and co-operation of the farmers in the control of disease and in other matters can do much.

As regards Gumming Disease which has an undoubted grip on N.G. 15 and M. 1900 and to a lesser extent on D. 1135 and N.G. 16 in the Woongarra, Rubyanna, and around Fairymead and Branyan, being absent in all probability from Bingera, the check caused by the recent drought is valuable in pointing out those fields that are heavily diseased. In a "two-years" variety like N.G. 15, death almost always overtakes some sticks in an infected stool before maturity, especially during dry weather; and furthermore, if one stool in a field is infected there is no guarantee that any stool is healthy. This is shown by the fact that in a five-acre field of first ratoon N.G. 15 inspected in June, only about a quarter of an acre showed "gum streaks." Now (November) most of the stools in the field have one or more sticks dying from gumming, the gum "sweating" best usually in the lower portion of the stick where the reddened "fibres" (vascular bundles) are most frequent. Other stools not thus affected show the leaf streaks. But the effect of drought has been minimised in this case by trash conservation. In another field, not thus protected, the cane, 8-months old plant, shows the streaks on every stool, though no death of stools is yet to be seen. Again in quite young plant and ratoon M. 1900 and N.G. 15 considerable bleaching (chlorosis) of the leaf tissues was seen. In these two latter cases it was not to be expected that the gum could be "sweated" from the cut ends of the stem unless there had been marked reddening of the vascular bundles. Where there are very few chlorotic stools it may be payable to eradicate them, for there is a possibility, but no guarantee, that they are the only diseased ones. No fields were seen which could be guaranteed clean, but there are many which are probably so. However, adequate control can only be undertaken by a resident officer who would make a complete survey and obtain the history of every block. In the meantime, farmers are advised before planting to get into touch with the Experiment Station, where they will receive every possible assistance.

Mosaic Disease was first described by Wakker, of Java, as Yellow Stripe Disease, in 1896, and circumstances point to its having been in that country for many years previous to that. It has been prevalent in every considerable sugar growing country, but has not been recorded until much more recently, probably due to the ignorance of the disease. It was first definitely recorded in Queensland in 1913, by Messrs Carne and MacBride (then of the C.S.R.) in B. 208, Rappoe, &c., on the Herbert River. It was then well distributed. Whether it was introduced in the first place; and, if so, by whom, is an open question. Certain it is that corn and cane have actually contracted the disease from sorghum through the corn aphis (E. W. Brandes, of U.S.A.). A similar transmission probably took place at Mossman, where one field of H.Q. 426 within which "volunteer" corn had been growing, was found with a few stools diseased. As the field from which the "sets" had been cut was healthy, the evidence is strong. In any case, as Brandes has said regarding the position in America, "no particular blame attaches to those who are responsible for the importation of this obscure disease."

Mosaic occurs on all types of soil, though a very rapid spread has been noticed on the river flats of Fairymead, Rubyanna, and Avoca. In thirty-four stools of E.K. 28, where one was infected in May, three were found to be diseased in November. In Maryborough there is a smaller proportion of infected fields, the

evidence pointing to Shahjahanpur No. 10 at Magnolia and Q. 813 at The Pocket, as the first carriers of the disease to the district. Shahjahanpur No. 10 is strongly to be discouraged. Eradication of diseased stools and careful selection of seed will soon rid Maryborough of this disease.

Fiji Disease was found on fifteen farms, and suspected of being present in an incipient phase on five or six others at Bidwell, Magnolia, The Pocket, Tinana, and Nerada. It was probably brought into the district from Beenleigh or New South Wales in D. 1135. Already M. 1900 has contracted the disease, being quite as susceptible as D. 1135, and was definitely infected in four farms, and suspected in one other. Every diseased stool of these varieties soon becomes a total loss. The fast that other varieties can and do contract the disease should convince farmers that the disease is an infectious one, though the means of transmission from stool to stool have never been definitely determined. The causal organism is unknown. In the galls under the leaves—which have been mentioned in the May report as the critical sympton of the disease—there have been found bodies which, however, have not yet grown or shown signs of life on the nutrient media on which microbes usually grow. One serious feature of the disease is the long period of incubation, canes often being infected for more than six months before the characteristic galls appear. In one field of first ratoon M. 1900 only one infected stool was found, and that one not remarkably stunted, the soil being rich. From another part of the field seed had been cut in September, and this must be considered infected for some time yet, say 12 months. In any case it cannot be guaranteed clean, being a quarter of a mile from infected D. 1135. This illustrates the seriousness of the disease, and the measures suggested for its control are drastic, because, as yet the disease is isolated. Every field inspected was apparently infected to a smaller extent than three per cent.

Control.—1. Plough out after harvesting every field which has been found infected, except plant and perhaps first ratoon cane.

2. Make periodical inspections of infected fields of plant and first ratoon cane for the purpose of eradicating diseased stools.

3. Do not attempt to select clean seed from an infected field. Some farmers have already unsuccessfully attempted to do this. No D. 1135 should be planted or sold for planting purposes by any farmer whose farm is diseased or suspected of being diseased. This applies to M. 1900 in those farms where it was found to be diseased. Petite Senneville, Q. 813, H.Q. 285, and in some cases M. 1900, on diseased farms were found to be healthy to all appearances, and may be replanted without much risk.

By putting these measures into operation, the growers will stamp out the disease, quickly and without undue loss; which is the most desirable end both to the grower and to the Bureau.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following report (14*th December*, 1926) from *Mr. E. W. Mungomery, Assistant Entomologist in charge of the Southern Entomological Laboratory at Bundaberg*:—

Pentodon Australis Blackburn.

Reference was made in last month's report to the damage inflicted on young plant cane by the "black beetle," particularly so on some of the Pialba cane farms. While this district was being inspected in October, several of these beetles were taken gnawing at the tender cane shoots. Generally one beetle was found associated with each affected plant, but in one instance a pair were found together. When captured early one morning these beetles were placed in soil in temporary containers, and on examining them the same afternoon two were noticed to be in cop. All of these were ultimately brought back to the Bundaberg laboratory, and when being removed from their containers, a few eggs were found intermingled with the soil. The beetles were then transferred to a large cage in which cane sets were placed in order to give them conditions as nearly approaching field conditions as possible. Egg-laying commenced almost directly afterwards, and at first was at a maximum, but since then the production of eggs has diminished very rapidly, and on my last inspection (10th December) though all the beetles were still living, only a few eggs were found.

The cage has been kept under constant observation and eggs removed from time to time, and these being fertile produced tiny grubs about a fortnight after being

extruded. Thus it has become possible to establish a relationship between the larval or grub stage and the imago or perfect insect. Unlike some of the other cane beetles which deposit their eggs in one batch, this Dynastid lays its eggs singly throughout the soil, and each egg is enclosed in a small pellet of earth, the grains of which the pellet is constituted being cemented together by some secretion from the female beetle. The inside measurement of each pellet is slightly larger than that of the egg when first deposited, but this evidently is done instinctively to allow for the swelling of the egg which takes place during the development of the embryo.

Grubs which resulted from these eggs have since been feeding voraciously and some have already reached the third instar, so that their life-cycle is evidently a very short one in comparison with some of the other Scarabaeid grubs found here. Technical descriptions of the various stages will be given later when the grubs have been reared through their pupal and imaginal conditions.

Notes on Cane Grubs.

Grubs have made their appearance at Avoca during the last spring and have been responsible for a fair amount of damage to first ratoon M. 1900 Seedling. The first noticeable damage appeared in patches towards the end of August and the beginning of September, and these grubs proved to be the larvæ of an undetermined Melolonthid, which is common in many parts of the Bundaberg district, and also at Gin Gin. Later, however, the remainder of the field became affected and showed further unmistakable signs of grub injury. This gave growers the impression that the grubs were moving en masse throughout the block of cane. This theory is commonly held by growers, more particularly in the Northern areas, where cane, in fields attacked by the "greyback" cane grub, dies out in widening circles, the doomed portion increasing day by day. Such an assumption has, by experiment, been proved erroneous and grubs for the most part remain in the stools where they originally commenced feeding. The circumstance of one patch dying and this being succeeded by another is explained by either of two conditions. In the first place one patch may carry a heavier infestation of grubs than another, in which case the more heavily-infested stools succumb quicker than the less heavily-infested stools; or, in the second instance in a field having an even infestation of grubs, a sudden loss of moisture in one part will show up grub damage before it will be noticed in another portion of the field which has not dried out so quickly.

Neither of these explanations would suffice for the case under consideration, and on examining the field again, subsequent damage was found to have been caused by grubs of *Lepidiota frenchi*, a species quite distinct from the former grub. These "frenchi" grubs were observed at the Elliott Heads to be hibernating as late as the middle part of September and were then in the second stage. On the advent of warmer weather they moulted and assumed the third stage, and once more commenced feeding at the cane roots, but this time more ravenously. This last feeding has been responsible for the damage which has just recently become evident. On the other hand, the other species of grubs were more or less active throughout the winter months, thus causing their damage to show up previous to that of the "frenchi" grubs.

The farm on which the above infestation occurred had not previously suffered damage from "white grubs" during the past twelve years, which constitutes the present owner's experience there, therefore other growers, although they may not yet have suffered through the ravages of grubs, should not indulge in any false sense of security against these pests. Other pests during this time of the year are likely to become troublesome and ratoons failing to come away evenly in conjunction with the remainder of the field are sure signs that something is amiss, and growers should investigate by digging out an affected stool. If, then, advice be needed, Southern growers should communicate immediately with the Southern Sugar Experiment Station, Bundaberg.

At present cane beetles are to be found in their underground chambers or cells at a depth of about 15 to 18 inches, where they have changed from the pupal stage. These are now awaiting good soaking rains, when a general emergence will take place. Mating and egg-laying will follow, so that any control measures that have in view the killing of the female beetle or the prevention of oviposition in cane fields, will automatically bring about a corresponding reduction in grub infestation during the coming year.

The following report (17th December, 1926) on a visit to the Tully canegrowing district has been furnished by the Assistant Entomologist, Mr. A. N. Burns, of Meringa, to the Bureau of Sugar Experiment Stations:—

Leaving Gordonvale on Monday, 29th November, a survey was made commencing that same afternoon, and continuing on the two subsequent days, of the Tully district cane areas, the chief object being to collect insect pests of cane occurring there.

Monday afternoon.—Visited several farms near the mill and a few back towards Feluga. On one farm only were pests causing damage to cane observed, and their injury was confined to the leaves of young ratoons, grasshoppers being responsible. I was informed at the mill that grasshoppers had for some little time been in evidence at this particular farm, so decided to investigate the extent of and nature of the damage sustained. About half an acre only was affected, and then so lightly that control measures were quite unnecessary. In some scrub adjoining this farm, feeding-trees of the grey-back cane beetle (*L. albohirtum* Waterh.) were shaken, but they yielded only a few beetles and about a dozen examples of the green cockchafer beetle (*Anoplognathus smaragdinus* Ohaus). In the evening a search for beetles was undertaken with the result of only a couple of grey-backs. It is evident that the emergence of these insects in the Tully area this season is very light indeed, for few only have been observed and plenteous rains had fallen—some six inches in the ten days before my visit to the district.

Tuesday.—Lower Tully and Euramo districts were inspected, by rail motor, and no pests of any importance were observed. On two farms a few Army worms (*Cirphis* sp.) were found feeding on the leaves of young plant cane, but these were comparatively few in number, so hardly any injury occurred. One travelling through the canefields cannot help being greatly impressed by the fertility of the district and the evenness and excellent condition of the cane. The whole district impresses one with its progress, for during the past twelve months almost 4,000 acres more land have been put under cane than in the previous year, and the growth of the township is remarkable.

Wednesday.—Visited more farms in Tully itself, directing special attention to one farm brought under notice as having had grubs. Through the courtesy of the farmer I was able to collect a fine lot of beetles from feeding-trees near the cane; these were the Christmas beetle (*Anoplognathus boisduvali* Boisd.). They had stripped the leaves off many of the feeding-trees, the tree attacked being the "Myrtle" (*Eugenia* sp.), which seemed to me to be rather unusual, for their favourite trees in the Mulgrave area are Eucalypts of several species. These beetles were very probably the imagines of the grubs previously noted by the farmer, for the description he gave coincided exactly with that of the grub of *Anoplognathus boisduvali* Boisd. At this farm also my attention was drawn to two distinct species of ants which were eating holes in the ends of newly-planted sets. Both species were numerous, and have yet to be identified. The smaller one of the two is probably a species of *Pheidole* judging by the similarity of the major and minor forms of worker to those of the common little brown house and canefield ant, *Pheidole megacephala.*

These ants, which in all probability are native species, have likely only temporarily directed their attentions to eating cane sets, for in all probability with the advancement of cultivation they will be driven back to the heavily timbered areas.

I would like here to take the opportunity of thanking the manager and chief cane inspector of the Tully mill for helpful information given, and kindness in placing at my disposal facilities for being able to visit outlying branches of the mill area.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received from Mr. E. Jarvis, Entomologist at Meringa, the following report, 22nd December, 1926:—

Prolonged drought conditions have again operated as a natural check on the numerical increase of our grey-back cockchafer, *Lepidoderma albohirtum* Waterh., and in the event of dry weather continuing, damage from this pest is not likely to exceed that experienced last season.

Instead of receiving the average rainfall of 9.87 inches during the five months which constitute a critical period in the life-cycle of this cane-beetle—viz., June to October (see report by the writer in "Australian Sugar Journal," vol. XVIII.,

pp. 546, 547), we registered only 6.28 in.; while the precipitation covering the months November and December, has, up to the present date (December 13th) been 1.63 in., as against 11.92 in., which is the average rainfall for these two months. During November and December of 1925 we had 5.98 inches, so that unless rain falls during the latter half of this month (December, 1926) we may reasonably expect even less grub injury this coming season than was caused by our grey-backs during last season.

"Army Worm" Outbreak at Hambledon.

A rather serious infestation of the caterpillars of *Cirphis loreyi* and *C. unipuncta* occurred during November last about half a mile from the Hambledon mill.

Most growers are familiar with these caterpillars, which occasionally travel in immense numbers, moving forward like a vast army, taking everything before them and leaving corn paddocks, canefields, or cereal crops completely stripped, only the bare midribs of cane or maize leaves &c. being left on the ground.

The moth of *Cirphis unipuncta,* which is the commoner of these two species, measures about 1¼ in. across the outstretched wings, which vary in colour from pale-yellowish or reddish-brown to buff or creamy-grey, and are characterised by having a tiny but distinct white spot near the centre of each upper wing.

Eggs of the earlier broods of this insect are generally laid on rank grasses in damp low-lying situations, from whence the swarms of caterpillars, after having quickly eaten the herbage around, move forward in search of fresh fields. At this stage they are usually half grown, and when in countless numbers able to effect great injury to young ratoon or plant cane, &c.

Fortunately, the caterpillars responsible for the present outbreak at Hambledon were found to be nearly full grown, and numbered only from three to six to each stool of cane. The crop, moreover, being well advanced could afford to sustain the percentage of defoliation inflicted without suffering great damage.

The control measures advocated by this Experiment Station, and which proved satisfactory, were those of spraying a strip of cane in front of the advancing caterpillars with arsenate of lead (2 lb. in 50 gallons of water, and administering poison-bait consisting of Paris green 1 lb., molasses 2 quarts, bran 20 lb., to which enough water is added to bring the mixture to a mass just moist enough to crumble between the fingers.

When using the lead arsenate spray, care should be taken to see that it be well stirred or agitated before it leaves the nozzle, in order to keep the arsenic from settling, and ensure even distribution of the poison. The poison-baits are usually scattered in fragments about the size of a walnut against the base of cane stools along the line of advance, or in furrows ploughed immediately in front of the army. The side farthest from the caterpillars is usually trimmed with a spade to a perpendicular face, or made to overhang slightly, and deep holes about nine inches square are dug at intervals along the bottom of the furrows. When the caterpillars tumble in thousands into one of these furrows their progress is stopped by the vertical face, and while travelling along the trench seeking an outlet they fall into the holes. When these become filled to the top a little kerosene or benzine is poured over the struggling mass, which soon succumb to the fumes and can then be shovelled out to make room for another batch.

New Cane Termite.

Until quite recently the only white ant known to destroy cane sticks by devouring the interior cellular portion was *Mastotermes darwiniensis* Frogg., the so-called "Giant Termite" of the Burdekin district. We must now add to our list of cane insects another species of Termitidæ, which Mr. G. F. Hill has identified as being *Coptotermes acinaciformis* Frogg.

This insect proves troublesome at times in canefields, where it not only attacks the sets after planting, but will occasionally tunnel in growing cane sticks to a height of three feet or more above the ground. An instance of such damage was first brought under notice by Mr. G. Bates, Assistant to Entomologist, who during September, 1926, observed that several sticks in a couple of stools of Clark's Seedling (H.Q. 426) on a farm at Aloomba had been killed by these termites.

The cane was planted about eighteen feet from a line of fencing, several of the posts of which were found to be infested by *C. acinaciformis.*

The winged form of this termite—according to Froggatt—"is of a general light-brown colour, and clothed with fine hairs. It measures just over half an inch from the front of its head to the tip of the closed wings."

Description of Soldier.—Head pale shining yellow, reddish on frontal portion; antennæ 16-jointed; mandibles projecting horizontally, black, about three quarters

the length of head; crossed over each other near basal portion, smooth, free from teeth, and curved near the points. Length of head and first two thoracic segments taken together about half that of the entire body (exclusive of mandibles).

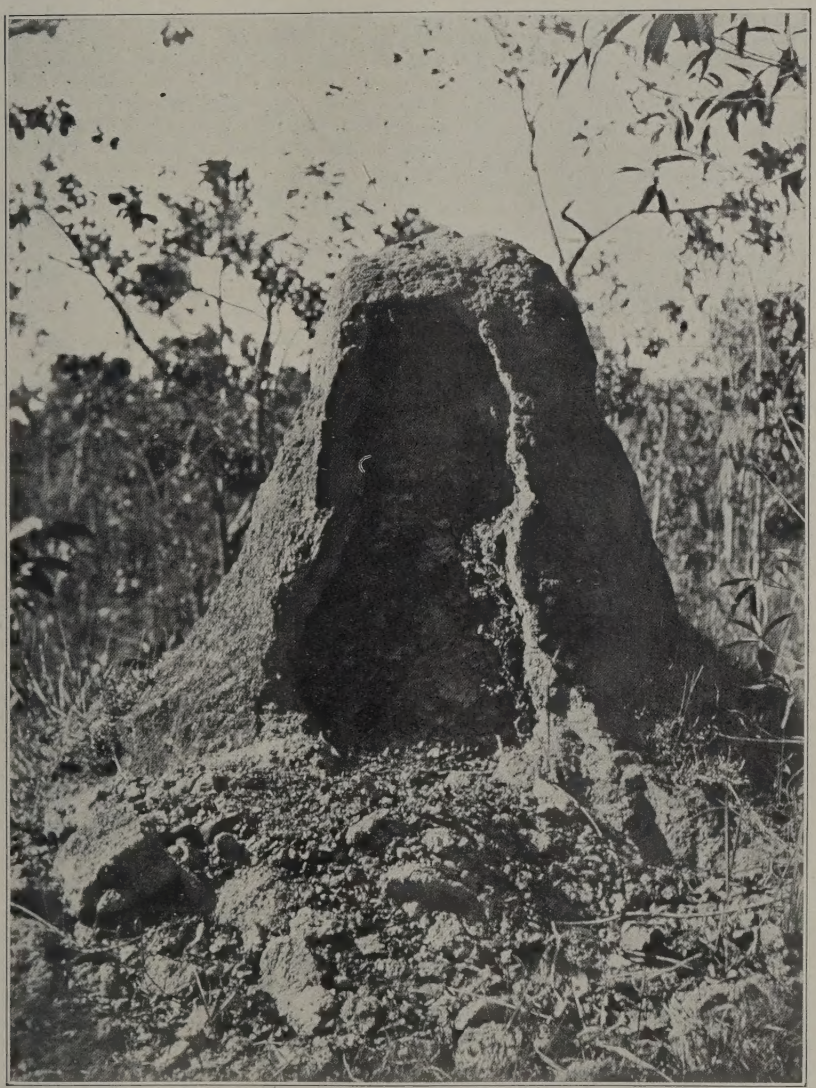


Plate 23.—Termitarium or Nest of "White-Ant" (*Coptotermes acinaciformis* Frogg.)

Laid open to show internal mass of galleries and chambers surrounded by external casing of hard earthy matter elaborated by the termites. (Height of nest about 5 feet.)

Abdomen whitish or pale cream-colour, with a narrow longitudinal centro-dorsal white band, edged on each side with a row of small triangular pale brown blotches. Length of body 5 mm. (about three-sixteenths of an inch).

The worker form of this species is whitish with pale cream-coloured head and antennæ. Its body is about the same length as that of the soldier.

This very common termite has a wide range of distribution throughout Australia; from Mildura in Victoria; Kalgoorlie in the West; Magnetic, Banks, Bathurst, and Thursday Islands; and several localties in Northern and Southern Queensland. The nest of termitarium of this species, which is more or less conical in form, varies in height from four to six feet in the Cairns dstrict. Internally it consists of innumerable thin plate-like woody-looking or papery fragments of irregular shape and size, forming a compact mass which is covered externally by a strong layer of cemented clay from two to three inches thick. (See illustration.)

Control Measures.—Fumigation of the termitarium with benzine or calcium cyanide provides an effective remedy against this termite. Such application is very simple and inexpensive, as one merely has to break a hole of about six inches in diameter in the top of the mound, pour in about a pint of benzine, and cover over the hole with wet soil or clay to keep in the fumes. When using the latter fumigant, from two to three ounces of "cyanogas" (flaked form) are placed in the hole which is then sealed with mud. Another method is to blow "cyanogas" in dust form by means of a knapsack dust blower into the termitarium. Experimentation carried out here recently with the abovementioned fumigants, against *Coptotermes acinaciformis*, yielded a mortality of from 97 to 100 per cent.

ENTOMOLOGICAL HINTS TO CANEGROWERS.

By EDMUND JARVIS, Entomologist.

Emergence of Greyback Cane-beetles.

Emergence of the beetles this season has again been delayed, no rain having fallen at Meringa in October and only 0.79 inches during the following month up to 22nd November. At one time it looked possible that they might have appeared on the wing towards the end of November. No emergence, however, has occurred during October since the years 1917 and 1918.

A fall of two or three inches of rain would be followed at once by the customary appearance of this pest in canefields and amongst the foliage of feeding-trees, so that growers should without delay be prepared to collect these beetles daily from any favourite food-plants chancing to be growing on or near headlands.

It would be a good plan to isolate such trees as broad-leaved or weeping-figs by cutting out surrounding vegetation within a radius of two or three chains, in order to induce these beetles to concentrate on them, which would facilitate the collecting from same.

During the first week, from 20 to 30 per cent of grey-backs taken in this way will be females, but by the end of the second week the sexes are usually met with in about equal proportions; while during the third and fifth weeks after a general emergence about 75 per cent. collected will probably be females.

Appearance of Small Brown Cockchafer.

The well known cane-beetle *Lepidiota frenchi* Blkb. will be in evidence during this month in countless numbers on forest country, and in canefields in which its third-stage grub proved injurious to young ratoon and plant crops last season.

Although one of our serious cane-beetles, second only to the grey-back in economic importance, this insect fortunately oviposits as a rule in uncultivated soil densely covered by grass or weeds, &c. Thus it behoves growers to maintain during December and January a system of clean culture on areas devoted to cane, and more particularly on land reserved for early planting.

Both *albohirtum* and *frenchi* lay their eggs during these months, and are strongly attracted by a luxuriant growth of vegetation between the rows, so that land remaining in a weedy condition is almost sure to become badly grub-infested.

During the present season, however, cane will be free from attack by *frenchi*, on account of this insect having a life-cycle of two years; so that no damage need be expected from it until September, 1927, when third-stage grubs of this species will again be actively feeding.

Farmers, Take Notice !

Growers seeking advice, or applying for the liberation of Tachinid parasites to be made amongst borer-infested cane, are asked to forward at the same time a sample of the insect causing the damage. Moth-Borer injury is frequently mistaken for that caused by the Beetle Borer, since both these insects are found

tunneling in cane sticks. No less than six different insects attack the shoots of young ratoon and plant cane, all of which effect very similar damage, being responsible for the occurrence of "dead-hearts."

When uncertain of the habits or name of any insect found injuring cane, it should be dropped into a small bottle containing methylated spirits and water (half and half), and posted to the Entomologist at Meringa Experiment Station for identification and advice.

[The foregoing notes were unavoidably omitted from the last issue. Though now somewhat late, they are still of general interest, besides it is desired to preserve their continuity.—Ed.]

Occurrence of Shoot-Boring "Bronze Beetle."

Growers should be on the look-out for damage caused to young ratoons and plant cane-shoots by the small chrysomelid beetle (*Rhyparida morosa* Jac.), which is betrayed by the presence of "dead hearts." Complaints regarding the depredations of this insect have been received during the last couple of years from growers in the Cairns, Proserpine, and Herbert River districts.

The beetle, which measures about a quarter of an inch in length, may be seen at any time during its adult period eating holes in the leaves of "blady grass" and in cane leaves close to headlands; while its larvæ habitually tunnel in the succulent basal portion of the former plant.

Such "dead hearts" usually occur in patches of more or less limited area, not often exceeding ten square chains.

A closely related species, *R. limbatipennis*, is known to effect similar damage to cane-shoots in the Proserpine district; this beetle, however, being if anything a trifle smaller than *R. morosa* and of a light brownish-yellow colour, instead of blackish-bronze.

Growers chancing to notice any decided infestation of either of these beetles in canefields are asked to communicate with the Entomologist at Meringa Experiment Station, either by letter or 'phone (95, Gordonvale).

Effect of Drought on Cane Beetles.

Prolonged dry weather has again checked the numerical increase of our grey-back cockchafer, and damage from this pest is not likely to exceed that experienced last season (see report for period November to December, 1926).

As a result of a few showers that fell at Meringa between the dates 14th to 20th December (amounting in all to 1.72 inches), some grey-backs were collected from feeding-trees close to the laboratory. Owing to want of sufficient moisture in the ground these beetles had experienced some difficulty in tunnelling to the surface. The few stragglers met with at present, however (21st December) cannot be considered as evidence of a primary emergence of this insect having taken place.

During this month farmers should try to have the soil loosened up and free from weeds, maintaining such cultural conditions for at least one month from date of emergence of the beetles. Work the soil close to cane rows while grubs are in the first instar, and quite small. This period, which commences about a month after first appearance of the beetles, occupies from five to six weeks. Encourage vigorous root development and conditions favourable to conservation of moisture by judicious manuring and thorough cultivation.

Clean Cultivation During Flighting Season.

Maintain clean cultivation, particularly on land reserved for early planting, and which on that account sometimes receives less attention than that given to areas supporting the present season's crop.

A dense growth of weeds between cane rows attracts egg-laden females of both *albohirtum* and *frenchi* (grey-back and French's cane beetles), the latter cockchafer being very fond of ovipositing in such places. Upon ploughing these areas later on (April to July) grubs of *frenchi*—being then in the second instar and rather small—are often disregarded; although, as a matter of fact, they still have six months in which to feed before pupating, and after the weeds have been buried are obliged to feed on the roots of the newly-planted cane, effecting most damage while in the third instar, from October to December.

FIELD REPORTS.

Mr. A. P. Gibson, Southern Field Assistant, reports (30th December, 1926):—

Babinda.

Babinda boasts having the greatest official average annual rainfall of Australia. The last ten years this has averaged 154 inches. Thirty inches had fallen since the local factory commenced grinding and 115 inches have been recorded to the end of November.

Soils.—The quality of a soil largely depends on the rock from which it is formed, and the crops that may be profitably grown are dependent on rainfall and climatic conditions. Here there are two distinct classes of soil—(1) The well-known undulating volcanic, brick-red fertile soils of Bartle-Frere and Bellenden-Ker—these have been formed by the long weathering of igneous rocks having haematite (red oxide of iron), hence its reddish colour; (2) alluvial—the remaining soils, cultivated or uncultivated, are of this kind, the make-up of which is the result of the constant crumbling on the higher elevations of granite, a crystalline rock; the detached matter held in suspension has been washed to the lower levels and subsequently deposited according to the velocity of the stream, hence the reason why its texture is found to be all the way from coarse to a very fine silt. This rock is composed mainly of three minerals—felspar, silica (quartz), and mica—therefore its soil is usually good in potash.

The Crop.—What is left of the 1926 crop looked wonderfully green and had made much cane. The rainfall being well distributed and not excessive had permitted the crop to grow speedily right up to August, when it was slowed down by the dry spell which then allowed of its fully maturing. Carry-over cane at first weighed disappointingly light for the reason, and because of the almost complete cessation of growth; the first estimate was reduced to 10,000 tons. Eighteen inches of rain fell during September, and awakened new and speedy crop growth, thus increasing the weight of cane and ensuring the harvesting of many doubtful late-cut paddocks and again advancing the estimate to 190,000 tons.

Harvesting and Grinding.—These operations were proceeding smoothly, most of the cane being burnt prior to harvesting. One hundred and sixty thousand tons had been milled to the 29th November, and another 30,000 tons yet expected. The quality of cane has been exceptionally high.

Ratooning and Cultivation.—Where possible, the trash is burnt and the soil interspaces are tilled by power-drawn ploughs or subsoilers. The rotary cultivator would possibly speed up and cheapen this class of work, especially in the less refractory soils. Loggy and stumpy lands are being freed of encumbrances. Explosives and fire are wonderful helpers. Tenth ratoons were harvested in parts this year, and the last crop removed was considered very satisfactory; such paddocks are becoming "gappy," and for the benefit of variety and soil should be renewed. Land kept continuously under cane without renewing permits the thorough entrenching of pests and disease germs, and the long growing crop is so weakened that it is subjected to disease. The lengthy empty spaces in some ratoons are being filled by stools removed from elsewhere; when the weather is suitable they at once grow and are not smothered. Farmers, however, should see that such stools are disease free.

Drainage.—Planters do not give enough consideration to the great value of this; a judicious system improves the crop and decreases disease losses. Leaf Scald appeared more prevalent on ill-drained soils.

Planting.—The crop is being constantly renewed by cuttings, therefore it is in our hands to improve crops by always using the best. Big areas had been planted; germination was erratic in some fields and remarkably good in others. Most of the cane raised is Badila. A percentage of H.Q. 426 and the Goru family is grown on soils considered too poor for Badila; if the Leaf Scald disease continues to spread as at present in such varieties, it would be really advisable to eradicate them. Q. 813 and E.K. 28 are worthy of a trial on the medium quality lands.

Manuring.—The application of fertilisers is commonly deferred in these parts until the stubble of plants or ratoons is well established, different mixtures at various rates per acre are then added to both sides of the cane row. The estimated quantity of manure for a day's application is sometimes loaded on to a wagon and drawn to a convenient spot by the tractor, after which it hauls the combined driller and manure-depositing machine. Some ten acres are manured daily in this manner. Farmers should make use of the sugar-mill residues more than they do; ashes and filter press cake especially are of great value to the soil. Leguminous crops are not largely grown, but are essential in helping to restore the depleted organic matter.

Diseases and Pests.—The gathering and destroying of dead cane in fields is of immense importance in helping to control our many diseases and pests. Leaf Scald continues to spread rapidly in parts, mainly in H.Q. 426 and the Goru family; fortunately to a much lesser degree in Badila, the present king of Northern canes. This disease presents a variety of symptoms that vary according to the severity of the attack. They are covered by what is known as (1) the chronic stage—when the leaf blades are almost white or have whitish streaks; (2) acute or wilting stage, when the plant quickly dies.

Top Rot.—Most of the troubled stems had lost their tops and are now dead; in isolated parts such decayed canes were covered in a fungus known as cane spume; this is generally considered to be a secondary disease.

Scarlet Red Leaf Streaks.—The foliage of Badila stools contained scarlet red streaky leaves, these appear to start at the topmost extremity of the sheath. Such markings are generally noted throughout the Northern areas from December to February, and are considered to be the early symptoms of Top Rot. The leaves of many paddocks of cane were found pitted with minute holes seemingly occasioned by small beetles. It is highly possible that these and Army worms may be assisting to spread the Leaf Scald disease by leaf inoculation. Pupæ of the tachinid fly (one of the known weevil borer parasites) were found in borer-channelled cane in the mill yard.

Recommendations.—Again we must impress on the farmer the vast importance of exercising more care over plant selection, also the necessity of going over the fields at intervals and removing and destroying sickly or diseased cane.

Herbert River.

This district has grown wonderfully, as most others also have, upon the recent tide of development of the sugar industry. In consequence, its sugar output has been doubled. Wonderful progress was noted in Ingham; the town has been modernised and has spread. The main street is wide and pretty, being beautified by the evergreen far-spreading shade trees.

Rainfall.—The year's precipitation has been far below the average. Up to the 15th December Ingham had registered 51.47 inches and Halifax 52.81. The area is drained mainly by the Herbert River. Its cane land is extensive, parts being isolated. The black to brown soil is alluvial and varies much in depth, texture, and quality. Generally speaking, it is level but bumpy. The great importance of draining is realised, for it has made cane-growing possible and profitable on the shallower and more retentive soils. The judicious system of hilling, upon which some dozen lines of cane are planted, permits water in excess to get away.

The 1926 cane tonnage will fall far short of the 444,000 tons crushed by the two local mills last year. This year it is likely to be some 127,000 tons less. Such a reduction is attributed to (1) the unusually long spell of dry weather; (2) severe July frosts; and (3) widespread arrowing. Macknade finished its crop of 158,475 tons on the 11th December, and is now assisting Victoria, its sister mill; in consequence it is hoped that the district crop will be milled by Christmas. The cane area has a most helpful network of railroads, which cheapen and speed up crop transportation. Some cane lands are distant, therefore requiring lengthy lines, much rolling-stock, and many powerful engines, to bring forward enough cane to ensure the continuous running of the two factories, also to take away the manufactured sugar to Lucinda Point, whence the coastal freighters accept delivery. When the area was first inspected, the weather was hot and dry, and the cane leaves parched; timely rains (amounting to 4 inches) however, revived the crop.

Cultivation.—Cultivation generally is good and the fields clean. It should not be forgotten that the mulching of soil interspaces as soon as practicable after rain is of great benefit, for it controls weed growth, prevents soil baking, and assists in conserving soil moisture. Farmers should exercise more care when turning animal-drawn implements on headlands, thus preventing headland cane damage.

The newly planted cane possessed a fine, healthy colour, but had not germinated too well. This was due to prevailing dryness followed by the continuous and excessive rains of September. The cane is planted in drills varying all the way from 4 to 5 feet apart, and the following varieties seem to be giving satisfaction:—Badila, grown on the deeper and better lands; Korpi, Nanemo, Oramboo, H.Q. 409, Q. 813, Goru family, and a little Pompey. The practice of mixing variety canes and planting them is not a good one and should be avoided.

Diseases and Pests.—Most of the matured cane had been harvested, therefore little disease could be found. The elimination of H.Q. 426 variety, a cane very susceptible to gumming, had apparently been the means of almost cleansing this area of this disease. It is refreshing to inspect an area so free from Leaf Scald, what little there is here may be eradicated by the ever-careful plant selection. Many streaky scarlet red leaves were noted, mainly in N.G. 15.

Pests.—Rats were rather bad in places, and besides eating the cane stem were found destroying the ratooning shoots, especially in unburnt, trashy areas. *Pentodon Australis* (black beetles) were widespread in this area and in places many primary plant shoots and also those of ratoons had been killed by them.

Alterations.—Firewood is becoming scarce and more costly to procure, consequently the local factories are preparing to burn a quantity of coal. To bring this fuel and other necessary mill requirements direct to the Victoria millyard by the Government rolling-stock, some 2 miles of 3 feet 6 inches line railroad had been constructed, connecting the mill with the North Coast line.

The company's tramway line passing thorugh the main street of Ingham is to be removed to another route, and the work on the new track has already commenced. The lengthy new wooden bridge spanning the Herbert River at Halifax is nearing completion.

The Southern Field Assistant, Mr. J. C. Murray, reports (16*th December*, 1926):—

Nambour and Yandina.

As the districts of Nambour and Yandina have been dealt with in considerable detail in previous reports, comment will be confined to conditions prevailing on the high lands and the creek and river flats. High lands embrace those areas between Nambour and the Mapleton Range, and these will be dealt with first. The soil is a chocolate loam with no great depth but considerable productive powers. It has never been intensively farmed up to the present, although well-cultivated areas are now showing at intervals. Very little green manuring has been done, and not much artificial manuring. No silos are in evidence, which is surprising considering this is largely a dairying district. Farmers should remember that these are the best possible insurance against drought.

Cane varieties growing on the area under review include M. 1900 Seedling, D. 1135, H.Q. 285, and Q. 813. All look well. Growers would find that the Java variety, E.K. 28, would do well on this undulating country.

No serious occurrence of disease was observed. Mosaic was in evidence here and there. This was pointed out to the farmers, and methods of control indicated. Complaints of loss by Gumming disease were not heard. Serious cane fires occurred in these areas during the season. These fires disorganise the cane inspector's work, and, whereas the burnt-out growers may get their cane off, other men who are just as entitled to a cut have to wait. The lower-lying areas are Petrie Creek, Maroochy River, and Yandina areas. Conditions generally on these farms are the same. The growers are finding there is one advantage about the present dry spell; it is an excellent time for combating the weed growth.

No serious losses were reported through gumming. There is plenty of evidence of the disease, mostly in the D. 1135. Growers in these areas are requested to be very careful in regard to Mosaic disease. If they allow it to spread after all the information they have received on the subject then they are careless indeed.

Cane varieties showing good growth in these areas at the present time are Badila, Q. 813, H.Q. 285, and Uba. Q. 970 is also making a good showing.

Cooroy and Eumundi.

These districts are unimportant from a cane-growing point of view. The farms are mostly dairy, hardly any farmers having more than 6 or 7 acres of cane. The cane gave a good c.c.s. value this year. A most surprising thing is that dairy farmers have not long ago found the value of a patch of cane from a stock-feeding point of view.

Leaf Scald disease was noticed on one patch of H.Q. 285. The following comment on this disease is by Mr. North, Pathologist to the C.S.R. Company:—"The one critical symptom which enables a positive identification to be made consists of whitish streaks on the leaf-blades or leaf-sheaths. They are straight, narrow, well-defined streaks ranging from one-eighth of an inch in width down to a barely susceptible mark, and often extend throughout the entire length of the leaf-blade and leaf-sheath. As the leaves grow older the streaks usually tend to broaden and become more diffused, losing their sharply defined, even margins. Sometimes irregular reddening of the tissues also occurs, especially in the centre of the streak.

The Central Field Assistant, Mr. E. H. Osborn, reports (19*th November*, 1926):—

Ayr.

The Ayr rainfall figures to date, *i.e.*, 15.94 inches, are made up as follows:—January, 142 points; February, 811 points; March, 162 points; April, nil; May, nil; June, 13 points; July, nil; August, nil; September, 466 points; October, nil; November, nil. This shows the important part that irrigation plays in this area, and moreover gives an idea of how very costly cane-growing can be under practically continuous waterings.

Some very good density returns were being obtained, Badila especially giving excellent results, even from several low-lying and rich soils carrying very heavy tonnages per acre.

Everywhere irrigation plants were in operation. Steam plants, suction gas, and the ever-useful tractor being very much in evidence. When the very large number of tractors is noticed, and the splendid work that they are doing in pumping and all sorts of cultivation work, it emphasises their immense usefulness in an area such as the Burdekin.

Varieties.—Of the newer canes E.K. 28 is being planted out in a much larger degree than formerly, especially in medium to poor land. Local growers speak well of its striking qualities, rapid growth in erect form making it stand up well to irrigation, as well as its quick recovery after a check in growth, with a freedom from side shoots when such a check occurs. One of the best results was obtained from an April planting of 11 acres, cut in July and August, and yielding 34 tons per acre for an average of 16.1 c.c.s. In the same area a 5-acre paddock cut 40 tons per acre in September for a c.c.s. of 16.0.

Q. 813.—A small area of this was seen carrying good length and very fair barrel, and will probably give about 35 tons per acre, but as the adjoining land yielded a 51-ton per acre crop of Badila with a very high c.c.s. it is not likely to be grown in any quantity in such lands.

Q. 903 was also showing a nice sample of cane upon this farm, but seems rather erratic in density. On this particular farm Nuttall Brothers, the owners, are doing useful work in continually testing new varieties under local conditions and in quantities large enough to give average results.

Pests and Diseases.—White ants are still doing a great deal of damage to isolated farms, notably at Jarvisfield and Brandon. In both cases the pest seems to be going further afield. At Jarvisfield a small block of early plant Badila was so badly affected that six rows nearest the creek were absolutely eaten out, and further away through the remainder of the block many dead shoots were very evident. At Waterview damage upon a larger scale has been inflicted, despite poisoning with recommended mixtures.

Moth Borers.—Damage to odd shoots in many fields of young cane was observed, but upon investigating the shoots no trace of grub or caterpillar could be found.

Top Rot in the Red Streak stage was seen in a block of young Badila on an area where it usually is to be found to a certain extent. Many stools were showing the streak markings in leaves, but only odd shoots had died out. Growers here say that when the cane is attacked before "making cane," and at about October or November, only odd shoots suffer, but if the disease is seen after cane has been formed there is a certainty of greater losses.

Leaf Stripe was noticed in a young paddock of B. 208, to probably a 5 or 6 per cent. infection, at Klondike, and odd stools were noticed in other blocks of this variety.

Mosaic was noticed only in an odd stool of H.Q. 426 ratoons.

Home Hill.

Crops looked on the average rather better than those upon the north side, both up and down the river.

The earlier planted young cane looked very well, but inclined to be going back; most of the recently planted cane will require very good conditions from now on to make into a good crop for 1927. Inkerman had just finished milling operations after a very satisfactory run to millers and growers, for although the individual grower did not harvest as much cane as last year, yet a much better density and a slightly higher price for sugar made the average conditions better.

It was pleasing to hear from nearly all the growers interviewed that the irrigation working conditions were now far more satisfactory than they had ever been; in fact, so much so that the writer was told by several farmers interviewed, who were not included in the system, that they have applied for power.

Neither up the southern side of the Burdekin nor the northern side had any serious delays occurred. In fact the writer saw a gang at Jarvisfield cutting standover Badila very twisted, and with a fair proportion of withered-up stalks, yielding probably a 12-ton crop. The cutting was very fair and all the damaged cane thrown out, and yet under Award rates; which speaks very well for the type of cutters employed and the good relations existing between employers and employees, incidentally also favouring the small-gang system.

Varieties.—The same varieties are practically grown upon the Home Hill area as upon the northern side. Some very fair results have been cut from E.K. 28 hereabouts, as the following figures reveal:—

	c.c.s.
11th September	16.1
18th September	16.1
25th September	16.4
2nd October	14.6
9th October	15.8
16th October	15.5

or practically 15.8 c.c.s. for a 40-ton crop on this class of country. The owners are so satisfied with these results that a further area has been planted out.

Diseases and Pests are practically similar to those upon the Ayr side of the Burdekin, and were seen only in very minor quantities.

A peculiar, or rather a characteristic, thing happened in connection with the Red Streak stage of Top Rot. Some growers, after suffering certain losses in Badila from Top Rot through a period of several years, thought that they would try plants from elsewhere, and about four years ago obtained a few sets of Badila from the Tweed River. These were planted and replanted until it now represents 1 acre of last April plants, and though it looks very healthy as regards general growth, it is heavily infected with Red Streak, quite a number of odd shoots having quite died out, the particular piece of ground never having been cropped before. The great risk of introducing fresh diseases into another district without the plants having been thoroughly examined by a competent official was in this case further emphasised.

The Central Field Assistant, Mr. E. H. Osborn reports (*18th December*, 1926):—

Giru.

Nearly all the available pumps were working, but in many cases there was only an indifferent water supply. The local mill had just completed its crushing of 31,773 tons of cane for an average c.c.s. of 14.6, while for 1927 some 54,000 tons are hoped for. Some 430 acres of early and 507 acres of late planted cane have been planted in the Giru area proper, whilst the Ingham railway line suppliers are represented by 412 acres of early and 405 acres of late cane.

Giru expects to have 858 acres of ratoons, and the Ingham railway line 943.

Varieties.—Following are the percentages for 1926:—

	Per cent.
Badila (N.G. 15)	50.0
Clark's Seedling (H.Q. 426)	30.0
Goru	5.1
H.Q. 409	5.5
B. 208	4.9
E.K. 28	1.7
Q. 813	1.3
Others	1.5
	100.0

Badila gave very consistent returns throughout the season, whilst B. 208 and H.Q. 426 were also very fair. E.K. 28 is credited with having stood the drought very well, giving good tonnage results but a density of somewhere about 14.5.

Pests.—Moth borers in odd shoots had done a certain amount of damage hereabouts.

Diseases.—None prominent in the area, but the dry conditions probably mitigated against detection to a certain extent.

Ingham Railway Line from Rollingstone to Tobanna.

When this area was inspected in the third week of November the cane looked far ahead of the local cane near Giru mill, the results certainly of the better rainfall conditions that had been experienced at Rollingstone, namely:—

	Rollingstone. Points.	Giru. Points.
January	395	714
February	782	1,800
March	342	180
April	—	250
May	20	—
June	22	—
July	—	—
August	—	52
September	478	808
October	—	—
November	—	104
	20.39 inches.	39.08 inches.

The 104 points for November fell during my visit, and it was wonderful to see the way the cane and the pasturage responded, brightening next year's prospects very considerably.

Crops from Rollingstone to Tokalon were backward in growth but of a very healthy colour. While in this particular area I was informed that an additional 900 acres of this land had been assigned to the Invicta mill, thus allowing at least a living area to the many small suppliers along this line, as well as ensuring a more reliable cane supply to the mill.

Though tonnages were small, the quality of the cane was satisfactory, Badila especially giving good returns.

Pests.—White Ant damage of a minor nature was noticed in a couple of Rollingstone farms. The attack was checked by using a poisoning mixture of molasses, arsenic, and caustic soda.

Grubs.—Damage was noticed on a portion of a field at Yuruga, but no beetles had been noticed so far.

Diseases.—Leaf Stripe in an odd stool of B. 208 ratoons was seen at Helen's Hill, but the owner was ploughing affected cane out.

Gum.—Suspicious looking leaf markings were noticed in H.Q. 426 and H.Q. 409 ratoons at Toobanna and Tokalon, but gum did not appear when sweated. Growers were advised.

Varieties.—Badila, as already mentioned, gave good average returns throughout. H.Q. 426 (Clark's Seedling) was also good, but is worth watching for disease. E.K. 28 was very fair for weight and c.c.s. H.Q. 409 was only medium in weight and c.c.s., and evidently won't stand dry weather too well. 7R 428 (Pompey), two truckloads from some poor forest land gave 40 tons per acre, but only 13.74 c.c.s. Korpi, Nanemo, and Oramboo in very small quantities were sent to the mill, but did not impress the line growers to any extent, and the same can be said of Goru.

Mackay.

Calen, Kolijo, and Mount Pelion, on the North Coast Railway, were inspected during the second week in December, and although very dry, looked better than other parts of the Mackay area. St. Helen's River was still running, and the pasturage in general was very fair, with some remarkably good and fat dairy stock to be seen. When it is taken into consideration that this section of the country has only been opened up for canegrowing some four years, its progress is only another tribute to the sugar industry's capabilities of settling our own people upon the land. Unfortunately the St. Helen's River flows between Calen and Kolijo, mitigating against centralisation for township purposes, and thus it is that while

Calen possesses the local school (built by the farmers' own labour) and is the railway siding for the greatest quantity of cane, yet at Kolijo is the staff station, general store, with post office and telephone facilities, and also a butcher's shop.

To emphasise how the area is growing, I was informed that the school has fifty-four children enrolled. Cane land is situated on both sides of the river banks and following its fertile flats down, being more extensive in area upon the Calen or northern side. The soil is mostly from a dark to lightish-brown in colour, deep in many places but fairly shallow in some others. It is also fairly gritty, and, resting as it does in the majority of cases upon a gravel subsoil, requires a good rainfall to enable the cane to do its best.

The tenure of the land is either freehold or perpetual leasehold, and quite a number of substantial, well built homes are to be seen upon the several farms. With the exception of a few large growers upon the Calen side of the river, who use tram rails and trucks for harvesting, nearly all the rest of the cane to both centres is shifted by motor lorry.

Mount Pelion.

This centre does not seem to have had as much rain as either Calen or Kolijo, consequently the crops were not as far forward. The country is also far more broken, with possibly the exception of the Murray Creek flats, of which several are fairly extensive. Both here and at Calen and Kolijo very heavy frosts had affected last season's cane adversely. Badila is the most popular cane upon such flats, and in all three areas were hit badly, with the result that the sugar contents were low.

Cane Varieties.—As already stated, Badila is the main cane upon the flats, giving phenomenally high returns in many cases, but through the very dry conditions, and later on the frost, was not too satisfactory as regards value. These values were in several cases affected by severe fire losses, and subsequent delay in harvesting. Pompey (7R. 428) also gave very high tonnage results upon the low lands, but inferior density returns. Upon the poorer forest soils the density was 14.5 to 15. Ratoons of both these canes looked green and vigorous and should develop into fair crops. Q. 813 and H.Q. 426 (Clark's Seedling) seem to have been planted in about equal quantities, and gave very satisfactory returns upon the medium soils. M. 1900 was only medium.

Diseases.—Mosaic was noticed in one stool of young plant B. 208 at Calen in three short rows of this variety, and rooted out by the owner.

Brown Rot, described by Mr. Cottrell-Dormer some two years ago as an unidentified fungus attacking Badila in new scrub land at St. Helen's (Kolijo) and Mount Pelion, was seen in small patches (generally only a few stools showing damage) upon the following farms:—At Calen, of nine farms visited the fungus had done damage upon four; that is, in plant cane and first ratoons in two cases each. At Kolijo, of four farms, two carried it in first ratoons. At Mount Pelion, of nine farms, only one showed damage in first ratoons. All these cases were in Badila and in new scrub or very heavy new forest country heavily stumped. As the fungus is spreading, though slowly, its importance was stressed to the interested growers, who, in most cases, rooted out the dead or partially dead stools. Keen interest seems to be taken in the various works of the department in this progressive area.

Pests.—Wallabies were responsible for damage to a lot of cane in these areas, despite wire netting and plenty of kangaroo dogs.

Cane Beetles.—Several growers reported noticing grey-backs upon the wing a day or two after the rain of 7th December.

The Director of the Bureau of Sugar Experiment Stations has received the following report (23rd November, 1926) from Mr. N. L. Kelly, Assistant to Pathologist:—

Cairns and Mossman.

Leaf stripe has been present in the Mossman district for many years, and is now appearing in several fields around Cairns, in 7R 428, having spread in two cases into D. 1135 adjoining. The losses caused by this disease, mainly seen in the premature death of infected stools, are considerably increased in ratoon crops. Because of the noticeable spread in humid climate the disease must be combated immediately. Those farmers who have noticed young cane with leaves of abnormal pallor—an appearance which is due both to the pale-yellow stripes and to the faint mildew

which appears on the under surface of the leaves—should notify an officer of this Bureau at once. Recommendations for control will be made according to the circumstances of the case. One farmer near Hambledon, where the disease was present in 1 per cent. of the stools of a 5-acre field of 7R 428, has agreed to dig out the diseased stools. This measure can generally be recommended in young plant or first ratoon cane where the degree of infection is less than, say, 3 per cent. When above that percentage, it is a question whether the cane should be allowed to remain in after harvesting. In any case seed that is only lightly infected rarely shows the disease until the plant crop is about nine months old. This occurred in a field of 7R 428 on the Sawmill Pocket road. The disease spread to a small area of D. 1135 adjoining, and the young ratoons are now showing very poorly. Some stools failed to ratoon, dry weather and disease each playing a part. Around Mossman Leaf Stripe is to be found in B. 147 in all the subdistricts, having spread into Q. 813 and D. 1135 in two fields at Saltwater and into one field of N.G. 24A., which is fairly resistant, at Mossman. The B. 147 at Brie Brie and Mango Park appeared healthy, though no guarantee can be given as yet. It is extremely difficult, in planting cane from a slightly diseased field, to be certain that only clean cane has been planted. The disease may be in the incubation stage in several of the stools selected as apparently healthy. Therefore every farmer should set aside a small area of his farm to be used as a nursery, and to which he should give careful attention. The digging out of stools that show Leaf Stripe or Leaf Scald will be repaid in the production of a crop which should be free of every major disease.

Leaf Scald is present in all subdistricts to the south of Kamma; Sawmill Pocket, Hambledon, White Rock, West Cairns, and Edgehill being infected to a lesser extent, but the Freshwater district is more heavily infected. Similarly it is to be found in

PLATE 24.

Two stems of Badila infected with leaf scald. The one on the right illustrates the chronic stage of the disease with leaves heavily blanched. The stem on the left is in the acute or wilting stage.

A cane stalk which has been in the chronic stage for some time, and dying.

all parts of the Mossman district. H.Q. 426 and N.G. 24 are suffering most, though the N.G. 15 of the Cairns district is practically all slightly infected. In isolated cases D. 1135 at Aloomba and 7R 428 at Saltwater were found to be infected.

Fig. I. shows two stems of Badila infected with Leaf Scald, that on the right being in the chronic stage, with the leaves of the top and of the buds heavily blanched, while that on the left is in the acute or wilting stage, the inner leaves being almost, and the outer leaves being quite dead. Fig. II. shows a stem which has been in the chronic stage for some time, and is now dying.

There is no doubt that H.Q. 426 gives good results in a great variety of medium lands in both Cairns and Mossman districts; but unless a farmer exercises great care at the outset, these good results will be gradually counterbalanced by disease. For absolute safety this cane should be planted from first ratoons which have received careful attention since planting.

Gumming.—Although the season was unfavourable for a speedy identification—based on the "leaf streaks"—a careful inspection of two fields of eleven months' old plant H. 109 at Aloomba revealed that already several sticks of cane have dead tops, and topmost eyes that have shot considerably. In many cases these are heavily bleached—chlorotic. Thus, in North Queensland, at any rate, the death of the cane tissues commences at the top and proceeds slowly downwards; unlike that due to Leaf Scald, which is a rapid wilting. In any case, Gumming was easily confirmed by the presence of "gum cavities," and by the ready "sweating" of the yellow globules of gum from the cut ends of a section of the stem. The large number of "misses" in these fields showed that the "sets" had been fairly heavily infected. Every effort should be made to "plough out" these fields now, as the losses incurred in other fields by the spread of this dangerous disease may considerably outweigh the expense of replanting. It is only necessary to be certain that no old stools are left living among the freshly planted cane for safety in next year's crop. In my opinion the millers should have the right of refusing cane which has been planted against the advice of a duly qualified officer.

Mosaic was found in H. 109 at Aloomba, Shahjahanpur No. 10 at Hambledon, and H.Q. 426 at Mossman; in each case, in one field only. H.Q. 458 seems a promising cane for medium and poor lands in both districts, a particularly fine crop being seen at White Rock.

RURAL CREDITS—STATEMENT BY THE ACTING PREMIER.

The Acting Premier and Minister for Agriculture (Mr. W. Forgan Smith) in the course of a recent Press announcement said:—"I note by this morning's Press that, speaking at Cooroy, Dr. Earle Page, Federal Treasurer, made reference to the Rural Credits Scheme in so far as it affected Queensland. If Dr. Page is correctly and adequately reported, I can only say that he handles facts in a very careless manner. So far from the Queensland Government being opposed to the Act because his Government passed it, we have been endeavouring for some time past to secure for Queensland producers the benefits which the Act purported to give. Up to the present Queensland Commodity Boards have not found it possible to make their financial arrangements through the Commonwealth Rural Credits Department, and marketing credits have had to be arranged otherwise with the assistance of State Government guarantees. Difficulty arose from the outset in connection with the interpretation of that provision of the Federal Statute which provides that produce financed upon 'must be placed under the legal control of the Bank.' Everything hinges upon what meaning can be applied to that provision. It could be interpreted to mean that such legal control might involve giving the Bank authority to decide when, how, and for what price goods may be sold. I take the view that this provision should not embrace any more than the ordinary security taken by the commercial banks in the usual way of business. The Commonwealth authorities also held the opinion that by reason of some alleged weakness, either in our Queensland marketing legislation or in the constitution of the commodity boards, there was some obstacle in the way of the granting by Queensland boards of the requisite form of security in compliance with the Federal Act. This matter has been under discussion for some time, and opportunity was taken of the recent visit to Queensland of the Chairman and Governor of the Bank to bring the matter to finality. After discussion, it was decided to refer this to eminent counsel for a joint expression of opinion on the question as to whether the Queensland Act is adequate to enable the giving by boards of the form of security required. The opinion was duly received, the joint advice being to the effect that our Queensland legislation is adequate to enable the authorisation of boards by Order in Council to give the form of security desired by the Rural Credits Branch of the Commonwealth Bank in accordance with the provisions of the Commonwealth Act. The Commonwealth Bank has now agreed to accept this opinion. I might mention here that the E. S. and A. Bank financed the Atherton Maize Pool Board, the security offering being accepted by that institution as completely satisfactory."

SUGAR-CANE DISEASES OF NORTH AMERICA AND THE WEST INDIES.

Report of Mr. A. F. Bell, Travelling Research Scholar, to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby.

The outstanding feature of the disease situation in North America and the West Indies is the fact that the diseases found are so few in number. Especially is this so in view of the haphazard methods of introduction of varieties which have prevailed in the past, and to a great extent prevail at the present time. The outlook for the growers is not particularly bright in any of these countries, and the immediate future calls for the closest scientific control of all phases of sugar production. Porto Rico, by virtue of participating in the United States preferential tariff of 1.78 cents per pound on raw sugar, is in a much more favourable position than its neighbours.

Mosaic.

By far the most widespread and the most important disease is the ubiquitous Mosaic which is causing extreme damage in certain localities. In spite of the ravages, however, the disease has not been without value in demonstrating the effectiveness of commonsense agriculture as a means of control for this type of disease. There is abundant evidence to show that Mosaic can be completely controlled, even under what appear to be the most unfavourable conditions.

The highest degree of infection, and the greatest difficulties in the way of eradication, were found in Louisiana. Here it was extremely difficult to find a healthy stool, and doubtless this complete infection is largely responsible for the hazardous condition of the Louisiana sugar industry. Practically the entire crop is composed of two varieties, D. 74 and Louisiana Purple, both of which are approximately 100 per cent. infected, and thus it is impossible to carry out any comparative tests to determine the losses due to Mosaic. Although it has been shown in Porto Rico that it is feasible to take seed from a field carrying as high as 90 per cent. infection, providing that the seed is rigidly selected and strict attention paid to the roguing of the young cane arising therefrom, it is obvious that this method of control is impossible under the conditions existing in Louisiana. Therefore it follows that any supplies of healthy or disease-resistant cane must be imported or raised from seedlings. Owing to its being some 7 to 10 degrees outside the tropical zone, cane does not arrow in Louisiana, and so it was necessary to seek some other locality for the carrying out of any breeding programme. The experimental station of the State University and the U.S.D.A. are now co-operating in order to alleviate the distress, and endeavour to restore the industry to its former position. To this end an experimental station has been established at Canal Point, in Florida, where introduced canes will be propagated for resistance trials; in addition a number of sedelings are raised annually and these will be tested out with the introduced varieties. At the time of visit the station was not very large and the number of seedlings raised was strictly limited; moreover the situation is rendered somewhat trying by the prevalence of floods in that particular part of Florida. The selected canes are despatched to various parts of Louisiana for a thorough testing in the field, the University Farm, Southdown, and Cinclare being three important centres. In addition to this the staff of the University experimental station are engaged in an effort to select disease-tolerant strains within the diseased varieties D. 74 and Louisiana Purple. Certain stools of diseased cane appeared to be tolerant to Mosaic and to produce a good stand in spite of of it; it was thought that these had possibly arisen as the result of a bud mutation and that continued selection would give a clone which would produce a good crop, although infected with the disease. At the time of my visit the selected canes certainly presented an improved appearance over the non-selected, but it must be remembered that, besides selection for any possible tolerance, there is also involved selection against Root Rot, Red Rot, and Borer infection. It cannot be said that this experiment shows any great promise and it is apparent that any relief must come from the new resistant varieties.

The reason for the rapid and complete spread of the disease in Louisiana does not appear to be far to seek. It is an established practice of the farmers to grow about half cane and half corn, and, moreover, to interplant the corn and the cane in comparatively small fields. An examination of the corn disclosed the presence of Mosaic in practically every field and on tearing away the leaves one could find large numbers of corn aphids, and experiments have shown conclusively that the corn aphid is capable of transmitting the disease. It is inevitable that

these aphids should transfer to the cane, even though it be but a temporary transfer owing to the insect preferring the corn leaves as a source of food. In addition the corn plants wither and die before the cane is harvested, and it is natural to assume that any aphids which might be present at that time would of necessity transfer to the cane. Owing to the comparatively low current values for sugar it is unlikely that the farmers will be persuaded to give up the growing of corn and this will be an ever present force militating against complete control. Recent experiments are demonstrating the suitability of Louisiana for the cultivation of the sugar beet, and thus it is within the bounds of possibility that Louisiana will cease to be a producer of cane sugar.

Root Rot.

The complex of troubles known as Root Rot is quite widely spread, but not much definite research or experimental work has been carried out to determine the contributing factors. It is claimed that the effects can be minimised greatly by soaking the seed in .1 per cent. mercuric chloride or commercial fungicides. The Federal station at Houma has the investigation of these troubles under consideration, and is probably conducting a series of researches at the present time.

A considerable amount of trouble is occasioned by borers, but not much by rats. There are also leaf spots and some Red Rot but these have not yet assumed any importance.

Cuba has hitherto enjoyed the position of being remarkably free from a great number of the most destructive diseases of sugar-cane; this is no doubt due to the fact that it has been largely a one-variety country, Crystallina constituting practically the entire crop.

A Remarkable Contrast.

As far as Mosaic is concerned this country presents a remarkable contrast between the entirely successful control by the more progressive estates and the ravages occasioned in the absence of control on the part of the native farmers and the badly administered estates. So far there has been no very serious attempt to organise a campaign against this disease. The Government maintains an experimental station where a pathologist is employed, but the purposes of this station are for general agriculture and it has not the facilities for the carrying out of an educational programme which will reach the small farmers. The Cuba Sugar Club has been formed in recent years, and is co-operating with the Tropical Research Foundation in the maintenance of a field experimental station at Baragua in Central Cuba. This organisation has obtained the services of some very able men, but its dealings will probably be with the larger estates rather than with the small farmers, or "colonos" as they are called in Cuba.

Most of the estates have an agricultural staff who tender advice to anyone forwarding cane to their particular mill. These men find it most difficult to convince the farmers that Mosaic is a disease, and their advice on this matter appears to be largely disregarded. The tendency is for the colono to take the thinnest and poorest quality cane for planting, with the result that actually he is selecting for Mosaic and not against it. It is a conservative estimate to say that on the colonias visited the percentage infection was at least 50 per cent. Grasses and weeds of various kinds grow profusely on the headlands and there is also a considerable amount of corn grown on these properties. The infection was observed to be heavier round the edges of the fields and in the foothills.

After having visited several colonias somewhat on these lines it was a pleasure to enter upon the large farm managed by Mr. J. R. Zell. On this property there was no Mosaic visible, although the surrounding colonias were heavily infected, as was this property when first taken over. The first procedure was to select cane and establish a clean seed bed and then, after planting, to keep the crop free from disease by constant roguing. Two men are constantly employed on this work, and when visited the infection was less than .01 per cent.; however, this extreme degree of care is possibly not quite necessary nor economically justifiable. The United Fruit Company's property at Preston is an example of successful control of the disease on a large scale. Here every effort is made to keep the percentage infection under 1 per cent. No corn is grown, and the headlands are kept free of weeds, while periodic inspections are made. The method of making the inspections is for a horseman to ride up the two boundaries and through two or three places in the field and make counts. If the infection is more than 1 per cent. labourers are sent in to rogue out the affected plants. A very big programme of Mosaic control is now being adopted by a syndicate which operates several mills in Oriente,

the eastern province. To take charge of the project, Mr. R. Menendez was brought from his position as Director of the Insular Station in Porto Rico; he is now putting into operation the methods which proved so successful in Porto Rico.

The Moth Borer.

The Moth Borer (*Diatræe saccharalis*) was found to be very widespread, and in the aggregate must cause tremendous losses; there are, however, no figures available on this question and very little is being done to combat the menace. A certain amount of Red Rot was seen, but this seemed to be present only after the cane had been damaged by the Borer.

As the lands are becoming older and more compacted, together with the generally poor cultivation, there is an increasing amount of Root Rots, although in the well-tilled areas there were no complaints. The effect of the root troubles, together with the spread of Mosaic, will inevitably exercise an adverse effect on the ratooning properties of the cane. The Cuban sugar industry has grown up largely on the wonderful ratooning capacity of the cane, and once this is removed it is hard to see how the small farmer can carry on.

New Varieties.

Just now a good deal of attention is being paid to the introduction of new varieties, particularly from Porto Rico, and of these the Barbados seedlings B.H. 10 (12) and S.C. 12 (4) promise to do well. Nevertheless the introduction of varieties from Porto Rico, without adequate quarantine, would appear to be very dangerous, since Gummosis exists in Porto Rico and inasmuch as Crystallina has been shown to be very susceptible to the disease.

The Industry in Porto Rico.

Sugar is responsible for about one half the income of Porto Rico, an island having an area of about 3,500 square miles and a population approaching one and a-half million. It is thus among the more thickly populated portions of the earth, and with most of the best land being used for cane culture the people are dependent on the outside world for most of their food supplies. Within this small area Porto Rico is fortunate in having two experimental stations; the Insular Government maintains one at Rio Piedras and the Federal Government one at Mayaguez. Both of these house pathology laboratories, and Dr. Cook is the pathologist at the former and Mr. Tucker at the latter. By virtue of the presence of these two centres the ætiology of most of the cane diseases of Porto Rico has been studied and comprehensive data gained on the question of varietal resistance and suitability in the varous districts. The stations are open to the criticism that they appear to have no adequate means by which the knowledge gained by the scientific staffs can be imparted to the small farmers. The major portion of the sugar is grown on comparatively large estates which are operated by men who have the training necessary for them to be able to read and apply the information contained in the scientific periodicals; in addition some of them have a pathologist employed in an advisory capacity. As far as the larger plantations are concerned the standard of the field control of disease is high; a few have their own experimental stations and carry on breeding and resistance trials, and rigidly supervise the seed selection and field sanitation.

Sugar culture in Porto Rico has been watched closely by the rest of the sugar world during the last decade owing to the rapid spread and consequent losses due to the Mosaic disease, culminating in the establishment of its true nature and the complete ascendancy of the methods devised for its control. The presence of the disease was reported in the Journal of the Department of Agriculture in 1917 by Stevenson and Johnston. Their attention had been drawn two years previously to an outbreak in a somewhat restricted area, but in the two years it had spread over one-fourth of the island. They state that a small infection in the first year would give a general infection in the second, with a falling-off in yield, while in the third year the crop might be a total loss. For 100 per cent. infection it was considered that the losses ranged from 50 to 70 per cent. No definite cause was found and no methods of control could be suggested. Two years later Stevenson published the results of his further work. He found that infection was ærial and not through the soil, and also that bacteria and fungi were not associated. He abandoned the degeneration theory and expressed his belief that the disease was an infectious chlorosis, due to a virus or an ultramicroscopic organism. The careful selection of healthy seed and the roguing out of diseased canes were recommended as a means of control. In order to save

the industry from its threatened extinction the Government had, in 1918, appointed Prof. F. S. Earle as a special commissioner to investigate the disease and devise means for its control. Prof. Earle gathered a staff and divided the work up into a number of projects as follows:—

1. The distribution.
2. An inquiry into eradication as an efficient means of control.
3. Methods of culture best adapted to badly diseased fields.
4. Statistics of sugar production as affected by the disease.
5. Methods of natural or artificial infection.
6. Resistance and immunity.
7. Ecological survey of the insect inhabitants of cane fields.
8. Cage experiments with insects suspected as carriers.
9. Morphological, histological, and cytological studies.
10. Studies on the nature of the disease and the search for a causal organism.
11. Chemical studies of diseased as compared with healthy cane.
12. Soil studies.

The results of these and other studies served to show that the disease was an infectious chlorosis which could be transmitted artificially and in the field was transmitted through the air by insects. No definite causal agent was found although Plasmodia-like bodies were found in association with the disease, and in the discoloured areas there was found to be a lack of chlorophyll and chloroplasts. As a result of these investigations the present methods of clean seed beds, seed selection, and eradication of diseased stools were advised and have been used with conspicuous success. By adopting these methods, Guanica, the biggest Central on the island, has practically eliminated the disease although starting with an initial infection of 90 per cent. In spite of the success of these methods vigilance is never relaxed, and at the present time all cane is inspected and rogued twice a month for as long as is practicable. On going into a heavily infected field the practice would be to rogue twice in the first day and then about five days later. After a field has been cleaned and an inspection shows one cane of a stool to be infected, this cane is cut off but the stool is not rogued out. It has been demonstrated by several tests that this is secondary infection and the rest of the stool does not show the disease later after treatment in this manner.

Mosaic Control.

Some interesting figures with regard to Mosaic control are given in the annual report of the Fajardo Sugar Company for 1924-25. The company's properties were very heavily infected when the problem was attacked in 1918 by the prescribed methods of clean seed and subsequent roguing. In the first year, 1918-19, 29.5 acres were abandoned on account of the disease. Since that year no cane has been abandoned, and the following are the number of inspections and the number of stools rogued out of the fields which had been planted with selected seed:—

	1918-19	1919-20	1920-21	1921-22	1922-23	1923-24	1924-25
Rogued	1756	1223	846	217	134	58	135*
Inspections ..		96	112	103	112	101	108

From this it will be seen that although the number of diseased stools has progressively decreased yet the vigilance of the agricultural staff is as keen as at first. Managers have found by experience that this is necessary to keep their fields clean and maintain their yields.

Gumming Disease.

In common with Australia and other sugar-producing countries, Porto Rico is unfortunate in having present the disease known as Bacterial Gummosis or Gumming (*B. vascularum*). It is not known whence this disease was imported, but its presence was first reported early in 1920 by Mr. Julius Matz, then pathologist to the Insular Experimental Station. Mr. Matz made a detailed study of the disease and published his results in vol. 6, No. 3, of the Porto Rico Journal. The disease was evident in the fields in the eastern end of the island in the summer of 1926, these fields having been planted with gummed sets. There is no doubt that the leaf symptoms exhibited by these particular diseased canes are identical with those used for

* This increase is due to the fact that some further fields were added to the company's holdings.

diagnostic purposes in Australia. However, these leaf markings do not agree at all with those described and illustrated by Matz as being typical, nor were markings corresponding to the latter found on the leaves of the canes in question. The other symptoms, such as the exudation of gum, discolouration and decay of the tissues, and failure to transmit through the soil, agree with those found under Australian conditions. It is the opinion of the agriculturists of the plantations, and this opinion is shared by Dr. M. T. Cook, that any spread of the disease is due to the organism being carried on the cane knives; there is no evidence pointing to the presence of an insect carrier such as is suspected in Australia. As far as can be ascertained there is no connection between rainfall and drainage and the severity of the disease. Although found in most parts of the island Gummosis cannot be said to be doing much damage, and the growers assert that its control is quite easy—due to the large numbers of resistant varieties of cane available. When the presence of Gummosis became known the heavily infested fields were ploughed out and replanted with resistant varieties. The Otaheite, or Cana Blanca, cane proved extremely susceptible and has been eliminated by the disease, while Rayada and Crystallina are following rapidly. With the eradication of these there are now no susceptible canes which are widely grown, and it is unlikely that this condition of affairs will be altered. Matz lists the following canes as highly resistant or immune:—Uba, D. 109, P.R. 233, P.R. 370, P.R. 272, B. 6202, B.H. 10 (12), P.R. 234, B. 3412, P.R. 219, P.R. 230, P.R. 417, P.R. 308, P.R. 209, P.R. 202, D. 433, D. 448, Yel. Cal., P.R. 292, B. 1809, P.R. 309, B. 109, P.R. 229, D. 117, P.R. 318, B. 347.

In addition to these S.C. 12 (4) has been introduced in recent years and has been found to be practically immune. B.H. 10 (12), which is highly resistant, forms half the crop on the basis of its general excellence apart from this property of resistance. The S.C. 12 (4) also gives high yields, and with two such canes as these Porto Rico is in a very favourable position as far as combating Gummosis is concerned.

Eyespot and Dry Top Rot.

The only other diseases of economic importance are Eyespot (*Helminthosporium sacchari*) and the Dry Top Rot (*Plasmodiophora vasculorum*). Eyespot has doubtless been in the island for many years, but first became severe in the winter of 1922-23 and again in 1924-25. The disease is most severe during, or immediately following, periods of heavy rainfall; infection takes place in the winter from November onwards. At present the importance is steadily diminishing owing to the eradication of the susceptible varieties such as F.C. 306, D. 109, and H. 109, in such areas in which the disease prevails. The fungus *Helminthosporium sacchari* undoubtedly exists in Australia, but so far it has not assumed any economic importance. The Eyespot disease starts as a very small reddish or occasionally black spot which becomes elongated but usually remains narrow. The centre becomes black and is surrounded by a yellowish zone which may be light green or almost white; the colours blend into one another and vary greatly in relative amounts. As the spots grow old they usually develop ashy coloured centres. They will vary greatly in length from ¼ in. to 3 in. or more, sometimes forming stripes from base to tip. In the young spots the colours are usually bright and clear, but as the spots grow old the colours become dull and disappear with the dying of the leaf. In severe cases the entire leaf, with the exception of the midrib, is practically covered with these spots, the result being the death of the leaf and a checking of the growth of the plant.

The Dry Top Rot was reported by Matz in vol. 6, No. 3, of the "Porto Rican Journal," and it is to be found in all parts of the island. The name of Dry Top Rot is not very satisfactory, inasmuch as similar external symptoms may arise from a variety of causes. The first symptoms are seen in a loss of colour, rolling in or wilting, and finally the drying of the tips of the central leaves. This is followed by the death of the growing points or uppermost joints of the canes which are shorter and thinner than normal. Often the drying of the leaves begins with one or more dead gray longitudinal stripes of about 1 cm. in width, at about the middle of the blades of the innermost leaves. The fibres appear lemon or orange red, due to the presence of *P. vasculorum* in the pitted vessels and annular tracheids. The discolouration is usually confined to the lower and subterranean portions of the cane stalk. A section shows spherical orange coloured spores and slightly yellowish granular masses of the plasmodium stage of the organism filling the vessels. The organism inhabits the fibrovascular bundles exclusively. During favourable weather the symptoms are not commonly noticeable, but they soon appear in dry weather. It has been found that the disease is transmitted mainly through the seed, but it is also transmitted through the soil. In control it is advised that healthy cane be carefully selected for planting, that is, cane from fields where the

disease does not exist, as seed selection within a diseased field is impracticable. In cases such as old ratoons, where the canes are short, the organism may be found all through the cane, but usually it is found only in the basal portions. Soils which are known to have produced heavily-infected crops should be rotated to legumes or some such crop in order to starve out the disease-producing organism, since all ingestigations have indicated that cane is the only host.

There is also, of course, a certain amount of loss due to root rots of various types, but not much complaint was heard in regard to this as far as the better tilled fields were concerned. The affected canes are characterised by a premature dying of the leaves from the borders in and general symptoms, such as the paling of the leaves and lack of growth, such as might be expected when the roots are not functioning properly. The trouble can be overcome to a certain extent by the use of resistant varieties, but the best means of control is the use of proper cultural methods which keep the plant in a condition to resist the attacks of the root fungi.

The Moth Borer (*Diatræa saccharalis*) and the White Grubs (*Lachnosterna* spp.) are widespread and do great damage. Some men consider that the White Grub causes more damage than any other pest in Porto Rico. On the properties of the Fajardo Sugar Company, 34 acres were abandoned during 1925-26 on account of the damage done by the White Grubs.

The Imperial College of Tropical Agriculture.

The British West Indies are fortunate in that, being very small in general, they usually have but one port of entry; thus it is comparatively easy to erect an efficient quarantine barrier against uncontrolled importation of foreign varieties and diseases. In addition nearly all their cane is grown under the plantation system which is a great help towards control when once a disease has been introduced. As in the case of Porto Rico, B.H. 10 (12) is rapidly becoming the standard cane on account of the outstanding yields obtained. Gummosis was found on the island of St. Kitts, where it was very severe on B. 6032; Otaheite (Cana Blanca) and Crystallina (White Transparent) are also found to be very susceptible. However, with the growing of B.H. 10 (12) and S.C. 12 (4) and the elimination of these susceptible varieties, the disease has not become a serious economic factor. Mosaic appears to have been introduced into practically all the islands at some time or other during the past few years; it is still prevalent in Jamaica, but the other islands appear to have eradicated it entirely by the prompt enforcement of laws compelling the eradication of all diseased stools. Contrary to the state of affairs in most of the British West Indies, Jamaica has a large proportion of its cane grown by the small farmers, and consequently control of the disease has proved much more difficult here than in other centres. The situation was very grave a few years ago, but was relieved by the introduction of Uba, which has constituted most of the crop since then. Although this cane gave a very low sugar content the tonnages were good and there is no doubt that it saved the industry from extinction. B.H. 10 (12) is now being grown, and the Agricultural Department is raising some seedlings from crosses with Uba. The small size of most of the islands and also the small amount of disease present make it impracticable to maintain pathology laboratories. Just now the only pathological investigations are those carried on in Trinidad at the Imperial College of Tropical Agriculture. This institution is, as yet, only in its infancy, but is undoubtedly destined to become a great force for the good of agriculture in the West Indies.

Readers are reminded that a cross in the prescribed square on the first page of this "Journal" is an indication that their Subscription —one shilling—for the current year is now due. The "Journal" is free to farmers and the shilling is merely to cover the cost of postage for twelve months. If your copy is marked with a cross please renew your registration now. Fill in the order form on another page of this issue and mail it immediately, with postage stamps or postal note for one shilling, to the Under Secretary, Department of Agriculture and Stock, Brisbane.

EFFICIENCY IN SUGAR GROWING.

By H. T. EASTERBY, Director of Sugar Experiment Stations.

Efficiency in the production of cane depends upon a number of factors, the principal of which could be summarised as follows:—

1. Each cane farmer should make a study of his soil, from both a physical and chemical standpoint. The analyses of cane soils are carried out free of charge by the Bureau of Sugar Experiment Stations, and a great deal of useful information can be gained in this way.

2. The equipment of a cane farm should be the best possible, and every attention should be given to the care of implements, preservation of harness, and the health and feeding of farm animals. Ploughs and other implements should not be left out in the weather, but be carefully greased and put under shelter as soon as finished with. The best and latest type of implements should, if possible, be procured, so that work may be done economically as well as efficiently.

3. Labour of the best type should be selected, and the farmer should aim at making his permanent hands comfortable, at the same time giving them to understand that he expects a fair day's work for a fair day's pay.

4. Proper methods of keeping accounts should be adopted on the farm, so that the canegrower knows what he is about and what each operation is costing him. Now-a-days a farmer has to be a sound business man to be efficient, as there are so many different phases requiring attention. He must be familiar with profit and loss, otherwise he will work in the dark.

5. Varieties of cane should be selected which are likely to give the highest results from a commercial cane sugar point of view, and yield of cane per acre.

6. In preparing for a plant crop, the soil should be thoroughly stirred by at least four ploughings, the depth of each being regulated by the depth of soil. In alluvial soils, such as river banks, subsoiling frequently gives excellent results in the shape of enhanced crops. Care should be taken that the soil presents a fine state of tilth just prior to planting.

7. The planting of cane should be very carefully supervised, and only good sound plants free from disease should be used.

8. Fertilisers should be judiciously chosen, and care should be exercised in purchasing, so that the best and most concentrated fertilisers are procured. The farmer should see that he obtains the manure he orders, and should not buy more manure than he intends using. Bags of fertilisers should be prevented from getting wet. Advice as to fertilisers can always be obtained from the Bureau of Sugar Experiment Stations. Rotation should be practised, and green manure crops, such as Mauritius bean and cowpea, made use of for maintaining the nitrogen and humus contents in the soil.

9. It may be necessary on some soils to apply lime for the purpose of sweetening soils, rendering stiff soils more friable, and correcting mineral acidity.

10. The weeding should be carefully and efficiently done, and headlands should be kept clean so as to prevent rats and other pests that injure cane. The canefields themselves also should be kept as clean as possible so that the plant foods in the soil go towards feeding the cane and not towards feeding weeds.

11. Farmers should endeavour to grow their own forage for stock purposes.

12. Vegetable and fruit growing on a small scale is also useful for the dietary of the farmer and his employees, while one or two cows will also prove valuable in providing fresh milk and butter.

13. Every farmer should have a small area for experimental purposes, both for the growing of varieties and the testing out of fertilisers.

It may be objected that to carry out all the above will put too heavy a load on the small farmer, but at any rate these ideals could be kept in view and gradually put into practice. Many farmers of course have adopted most of these objectives towards efficiency and are successful accordingly.

WATER FOR IRRIGATION AND STOCK.

By J. C. BRÜNNICH, Agricultural Chemist.

Every now and then reports are received from the country according to which crops have failed, soils have become unworkable and sterile, on using certain waters for irrigation, and again heavy mortality among stock has been caused by being forced to drink brackish water.

Analysis in such cases always demonstrates that the water was unfit for the use it was put to.

Numerous **analyses of water** are carried out every year in our Agricultural Laboratory and many samples have to be condemned, and it is therefore of the greatest importance that pastoralists and farmers should make use of the Department's services in all doubtful cases.

As it is quite impossible to give with each analysis full explanations of the terms used, and more particularly the reasons why certain waters are not suitable, and why it is practically impossible to improve or purify such water by simple means, it will be of general interest to give here a few **notes** on **water in general,** and on the conditions under which **waters** are **suitable for irrigation,** or **watering of stock** in particular.

Water is one of the simplest chemical compounds, and consists of a combination of the two gases Oxygen and Hydrogen. It is very widely distributed, and nearly four-fifths of the surface of our earth is covered with water, to an average depth of about 12,000 ft.

Water is one of the most wonderful gifts of nature, and has been recognised as such since time immemorial. Life could not exist without it, as it enters largely in the composition of all living matter. Animal bodies contain from 40 to 70 per cent. of water, and plants even up to 90 per cent.

Chemically pure water is difficult to prepare, and is a perfectly tasteless and odourless liquid. Even **distilled water,** unless prepared with special precautions, will contain small amounts of impurities.

Water is a great **solvent,** and this property to readily dissolve gases, liquids, and solids is of great importance in the household of nature. Water left exposed to the air absorbs gases from the atmosphere, and **rain water** will therefore contain about 4 cubic inches of nitrogen, 2 cubic inches of oxygen, and 1 cubic inch of carbonic acid gas per gallon. If we compare these amounts with the composition of the atmosphere, it will be found that the ratio of composition has been completely changed, as in the atmospheric air we find 4 volumes of nitrogen to 1 volume of oxygen, and only small traces of carbonic acid. This fact that the air dissolved in water is much richer in oxygen is of the greatest importance to the life of aquatic animals. The increased amount of carbonic acid increases its solvent action on soils and rocks.

Rain as it falls, not only dissolves gases, but collects other impurities, as dust, bacteria, and also small traces of salt, ammonia salts, and other nitrogenous compounds.

Next to rain water the water from melting snow and ice, as found in alpine mountain streams and lakes, and having passed only over

hard crystalline rocks, is the purest water. As soon as rain water, or other water, passes through the soil, or layers of more soluble rocks, many mineral matters are dissolved, and change the character and taste of the water, which reappears again in form of springs, or is found in wells and bores. The water originally **fresh water,** containing only small amounts of mineral salts in solution, may have changed into a **mineral water,** containing large amounts of mineral matter.

Of such **mineral substances dissolved** the most important are:—

Lime salts, as calcium carbonate (*chalk or marble*) and calcium sulphate (*gypsum or copi*).

Magnesium salts, as magnesium carbonate (*common magnesia*), magnesium sulphate (*Epsom salt or salts*), and magnesium chloride.

Sodium salts, as sodium chloride (*common salt*) sodium sulphate (*Glaubér's salt*), and sodium carbonate (*washing soda*).

The behaviour of water when using it washing with soap gives a fair indication of the amounts of mineral substances dissolved. Comparatively pure water, like rain water, readily produces a lather with soap, and is therefore called **soft water.** On the other hand, water containing lime and magnesium salts in solution, as frequently found in springs, wells, &c., are **hard waters,** and when rubbed with soap appear to produce a curdy or flaky precipitate, and only after considerable time a lather can be obtained. This action is a purely chemical one, caused by the mineral salts in the water decomposing the soap.

As a rule, a water of medium hardness, containing mineral salts and gases in solution, is more palatable and better for drinking **purposes** than a very soft water. For household purposes and factory use soft waters are generally to be preferred, as hard waters, besides leading to great waste of soap, on boiling and evaporation give cause to formation of boiler-scale; and some have a corroding action on metals.

One of the most pronounced mineral waters of nature is **sea water,** which contains about 3½ per cent. of solid matter in solution, three-fourths of which is common salt, or expressed in terms more generally used, sea water contains about 2,500 grains of total solids per gallon, of which 1,890 grains are sodium chloride or salt.

Water fit for drinking can be obtained from sea water by a process of distillation, as practised frequently at sea.

Salt, used in excessive amounts, acts like a poison, and therefore animals could not drink strongly **saline** or **brackish water** for any length of time.

Many of our well waters, and waters from shallow bores are saline, but fortunately the **water from artesian bores** are comparatively free from salt. Among about 180 analyses of bore waters, recorded in Dunstan's "Queensland Mineral Index," only ten contained more than 100 grains of salt per gallon, and only six of these more than 300 grains.

The **toleration** of various domestic animals for **salt** has not been accurately determined, and will depend naturally on many circumstances.

We have records that water containing from **600 to 700 grains of salt per gallon caused heavy mortality** among sheep, after using such water for a few months.

Water containing up to **300 grains of salt** per gallon may apparently be **used safely,** although many animals will refuse to drink the water with even this amount. Should water contain from 400 to 600 grains of salt per gallon it should be used for watering stock, in case of necessity, for short periods. Water with still higher amounts is generally unfit for stock.

With regard to the **alkali carbonates,** chiefly soda carbonate, very little is known of its effect on animals, and in the quantities usually found in artesian bore waters no harm appears to be done. Among 180 samples of bore water, already referred to, 109 contained up to 20 grains of sodium carbonate per gallon, the remainder containing more than 20 grains.

The maximum amount of salt recorded in bore water is 1,200 grains per gallon, and the maximum amount of sodium carbonate 576 grains per gallon.

In **Victoria** and **South Australia** water containing **400 grains** of salt per gallon is considered **safe for horses,** with **600 grains safe for cattle,** and **700 grains for sheep.** Water containing as much as 900 grains of salt per gallon has been used for sheep for long periods, and apparently caused no ill-effects, as long as the precaution was taken to allow the sheep to drink only at night time. Evidence collected in **New South Wales** led to the conclusion that **horses** will thrive with water containing **400 grains** of salt per gallon, and **cattle** and **sheep** thrive with water up to **800 grains** per gallon, but the evidence is rather contradictory, as smaller amounts in many cases showed ill-effects and caused mortality.

The fact of our artesian bore waters being more or less alkaline is of greatest importance when such waters are intended to be used for **irrigation,** as **alkali carbonates** (sometimes called "**Black alkali**") have a very bad action on soil and destroy plant life at certain concentration. Such alkali acts on the humus and the clay in the soil, and often renders it unfit for cultivation, by making it puddle in wet weather, and causing it to dry up into hard cement-like masses after dry spells.

The amount of **alkali carbonate** to be **tolerated** in **irrigation water** depends largely on the quality of the soil, methods of cultivation, and frequency of the use of water.

It is a well-known fact that the **combinations of various salts** in water or soil have an **ameliorating** or **antagonistic effect** on each other, thus minimising the toxic effect of the single salts. It was also found that the **toxic effect** of salts **varies** not only with the **actual amounts** present, but also with the **proportion of the amount** of the different salts to each other. A water containing 28 grains of sodium carbonate per gallon and 50 grains of sodium sulphate allowed some plants to live, whereas water containing the same amount of carbonate and only half the amount of sodium sulphate caused the death of all plants.

Professor Hilgard reports a case from California, where orange trees were killed within three years, by irrigating them with a water containing 21 grains sodium carbonate and 63 grains salt per gallon.

At the Moree Experiment Farm, in New South Wales, opened in 1899 and closed in 1910, bore water containing about 45 grains total solids, of which 34 grains sodium carbonate, per gallon, was used, and even after eight years' continual use excellent crops of oaten hay,

wheat, sorghum, and maize were grown. In this case the soil, a heavy black loam, contained about 1½ per cent. of lime. On lighter classes of soil the effect or irrigating with such alkaline water might not have been so successful.

No hard-and-fast rule can be laid down to judge the **suitability of water** for **irrigation,** but it may be accepted that a brackish or saline water containing about **100 grains total solids,** chiefly consisting of **sodium chloride,** per gallon, is the limit for safe use under favourable conditions. The maximum amount of **soda carbonate** can be taken between **15 and 30 grains per gallon,** according to the nature of the soil to be irrigated and amounts of water to be used.

The injurious action of soda or black alkali may be counteracted to a large extent by heavy applications of **gypsum** to the soil.

The neutralisation of the alkali in the water with strong **nitric acid** has also been advocated, but will on account of expense be never of practical value. On a small scale, to grow a few flowers and vegetables with alkaline bore water irrigation, no other water being available, this treatment of water with nitric acid has proved successful in a few places. But even this treatment has its limits, as continual applications of water containing nitrates (saltpetre), although a great fertiliser, will similarly act on the soil as the alkali carbonate.

In all cases where alkaline bore waters are used for irrigation, the effects on soil and crops should be carefully watched, and the water should never be applied in excessive amounts. The ill-effects of mineral waters on plant life are chiefly due to concentration of the solutions in the soil, and even from waters containing only small amounts of mineral salts, dangerously high quantities may be left in the soil after repeated irrigation in hot, dry weather, which would not be removed until some heavy showers of rain have fallen and the ground is well drained and porous.

Flooding land with **sea water** causes injury to the soil lasting for many years, due to a direct **harmful chemical action** of the salt, and also chiefly to a greatly **impaired physical condition** of the texture of the soil.

Some large areas of land covered with sea water by exceptionally high tides in England in 1921, were under water from two to fourteen days. Land which was originally under grass recovered after three years, but arable land was still unsuitable for cultivation in 1925, although the amount of salt present in the soil in 1924, due to leaching effects of rain, was only 0·05 per cent., an amount harmless to most crops. The soil showed layers of slimy clay, easily puddled into soft mud, which on drying baked into very hard clods. Any attempt at cultivation made conditions worse.

With regard to **analysis of water,** the results are generally stated in **grains per gallon,** and the first value given is the "**total solid matter,**" left on evaporation of water. This solid matter may contain besides mineral salts organic matter and small amounts of combined moisture, which are driven off, on heating the residue to dull red heat. The difference in weight before and after heating is recorded as "**loss on ignition.**"

The amount of "**chlorine**" in the water is given as such, and also calculated as **sodium chloride** or **salt,** although not necessarily all the chlorine is combined with soda, but may be present partially in form of magnesium chloride or calcium chloride. The "**hardness of water**" is expressed as lime carbonate, and when water is supposed to be used

for boiler purposes the amount of **temporary hardness,** due to mineral matters being removed on boiling the water, and the **permanent hardness,** due to more soluble lime and magnesia salts, remaining after boiling, are given. Any other alkalinity is recorded as sodium carbonate. When samples of water, intended for irrigation or watering of stock only, are taken for analysis, no special precautions, as recommended for drinking water, are necessary, and any ordinary clean bottle may be used, about a quart of water being required for analysis.

It would be of great interest to **collect further evidence** throughout the State with regard to the **use of alkaline and saline waters** for irrigation and watering of stock. Any signs of disease in crops, or stock, should be carefully observed and reported to an inspector, who then could submit samples of the water in use for analysis, which would be made free of charge. In order to ascertain the tolerated amounts of salt and alkali, inspectors should inquire into cases, where such waters are successfully used, and submit such samples of water for analysis from time to time. In many cases the salinity of well water diminishes after the well has been in use for some time, and all such facts are well worth recording and reporting.

PLATE 25.—MR. S. S. HOOPER, ACCOUNTANT, DEPARTMENT AGRICULTURE AND STOCK.

BROOM MILLET.

Some years ago we were permitted to reproduce an excellent and exhaustive bulletin on broom millet by Mr. G. Marks (then Inspector of Agriculture, Hawkesbury Agricultural College), Manager of the Government Experiment Farm at Grafton, New South Wales, and published by the New South Wales Department of Agriculture. In response to numerous inquiries from different parts of the State on the cultivation, harvesting, and marketing of broom millet it is deemed advisable to reprint Mr. Marks' bulletin in a somewhat abridged form.—Ed.

Requirements of the Trade.

In the manufacture of brooms, three classes of brush are required, which are popularly known as "inside," "cover," and "hurl."

"Inside" millet is used for forming the inside of the broom, and is generally not more than 17 in. long.

"Cover" is the class used for covering the inside and also for forming the shoulders. It is longer than the former, and must be from 17 to 20 in. in length.

"Hurl" is the longest brush, ranging from 20 to 25 in. It must also be fine and straight, and forms the outside covering of the broom. To give a nice finished appearance, only prime hurl can be used.

About 1½ lb. of brush are required to make an ordinary broom, and the three grades are used in about equal proportions.

The soil, climate, and methods of cultivation determine largely the quality of the brush, but in an average season there would be sufficient of each produced to satisfy the requirements of the trade. When grown under exceptionally favourable conditions, a larger proportion of long brush is produced. It may be used as covers, but owing to its length a certain amount has to be cut off, so that its use for this purpose causes unnecessary waste. On the other hand, a dry season will have the effect of stunting the growth, producing a large percentage of "inside" millet, which can only be worked in the inside of brooms. Manufacturers have consequently to purchase elsewhere to satisfy their requirements.

It is not intended to go into detail concerning the manufacture of brooms, as this does not exactly concern the grower. Manufacturers require certain classes, and the farmer should aim at producing those classes which invariably give profitable returns.

Fully 90 per cent. of the millet produced in New South Wales is grown on the rich alluvial lands of the North Coast; and on several of these rivers—notably the Hunter, Manning, and Richmond—the industry may be looked upon as lucrative and permanent. Many farmers have reported their success with this crop, and would not think of reverting to the far less remunerative occupation of maize-growing. The raising of millet need not be confined to these districts, as, with the necessary care, and the aid of a few home-made contrivances, any land which produces 25 or more bushels of maize to the acre will yield profitable returns. On many of our western slopes millet should also thrive, particularly in those localities where irrigation can be carried out. It is advisable, before entering extensively into the production of broom millet, to ascertain from agents or manufacturers the probable requirements of the trade, with the view of obtaining an idea of the prices likely to be obtained during the season. At the same time, should the prices fall after the crop is harvested, the millet may, if properly cured and baled, be stored for a considerable length of time without injury.

The following information may enable beginners in broom millet growing to avoid some common mistakes, and not to neglect any of the important operations which are essential to success:—

What Broom Millet is.

Andropogon sorghum vulgare is a non-saccharine variety of sorghum. It is an annual, somewhat similar in appearance to maize while young; but it has thinner stems and narrower leaves, and, instead of having male and female flowers on separate parts of the plant, they are both found together in the brush at the top. The flowers are of two kinds—perfect and imperfect. The former are set directly upon the branch, and are accompanied by some of the latter, raised upon little stalks. The fine stems of the panicle or brush are the valuable portions; the other parts are incidental. The brush should be composed of seed stems, uniform in size, length, elasticity, and toughness, and of a nice bright colour. The soil and general methods of cultivation will largely affect the character and quality of the product, even though good seed be used. By long and careful cultivation and systematic selection certain desirable qualities have been developed and fixed, which remain

PLATE 26.—A FIELD OF BROOM MILLET AT GOOMERI.

only so long as the conditions which brought these changes about are reasonably observed. When a plant is grown for a particular purpose it should be the cultivator's aim to keep improving it in the direction most profitable to him. This necessitates a careful study of the plant and its requirements, and the conditions which makes for its proper development. In broom millet it is not desirable to obtain a heavy yield of seed, a large development of stalk and leaf, or a sap full of saccharine material, but a special and unusual development of the long, thin stems of which the brush is composed. It makes very little difference whether a large plant is produced or a heavy crop of seed is obtained, provided these stems are long and fine.

Class of Land Required.

The soil requirements of broom millet are similar to those of maize. The best results are obtained from the deep, rich, well-drained alluvial lands of our rivers. It is, however, capable of adapting itself to a variety of conditions, and with proper care and attention, sandy and even gravelly soils, if thoroughly drained, will produce fair returns. Undrained lands make the working and cultivation more difficult; the growth is generally slow and uneven, and there is always the liability of the crop becoming stunted and diseased. To ensure evenness in ripening a soil uniform in character and fertility is essential.

Place in the Rotation.

In the general rotation on the farm, broom millet takes the same place as maize. It is not advisable to adopt the practice of growing it in the same piece of land continuously, unless suitable fertilisers are applied. It has been found, however, in dry seasons, that it does not thrive as well on land following millet as where the previous crop was maize. The reason of this appears to be that, being more drought-resistant, it continues to grow, and thus exhausts the soil of its supplies of moisture and plant-food, when maize would probably cease growing. At the same time, as the brush is usually harvested soon after the flowers have set, the crop can scarcely be classed as a very exhaustive one, particularly if the stalks are cut down immediately afterwards. Where possible, it should follow a leguminous or root crop.

Preparation of the Land.

To obtain the best results, the land must be properly prepared and brought to a fairly fine tilth before sowing. The previous treatment should be such as would destroy weed seeds. The presence of weeds in the early stages seriously interferes with the growth and cultivation of the young plants. Deep ploughing is recommended. This not only ensures greater feeding room for the roots, but it also has the effect of increasing the moisture-carrying capacity of the soil—a fact which must always be remembered, especially in those districts where the rainfall is limited and irregular.

The nature of the subsoil must also be considered. Clays should not be brought to the surface, but can be materially improved by subsoiling. Ploughing operations should be commenced a couple of months before sowing time. This not only allows the land to sweeten by exposure to the weather, but all vegetative growth turned under is generally well decomposed by the time the second ploughing takes place. In early spring the land should be well fined down by means of the harrow, disc, roller, &c.

Sowing and Cultivation.

Sowing should not take place until all danger of frost is over and the soil is thoroughly warmed, so that the seed will germinate at once. September, October, and November are usually the best months. If planted too early, there is not sufficient heat in the soil to cause the seed to germinate, and it will either rot or the young plants will be so weak that the weeds will very quickly outgrow and smother them. It may be sown about the same time as maize, or two or three weeks later, with advantage. Drills 4 or 5 in. deep are struck out with a plough (a double mould-board one is preferable) about 3 or 3½ ft. apart, and the seed planted along these by hand or machine. The latter is preferable, as it sows more uniformly; and, by using a fertiliser attachment, chemical fertilisers may be applied at the same time. An ordinary maize seed-drill, which sows and covers the seed in the one operation, is one of the best for the purpose. During hot or dry weather the seed should be sown soon after the drills are opened, and before the soil has had time to dry. When this system is adopted, hilling can be dispensed with. It prevents a great deal of evaporation from the soil by exposing a smaller surface. Besides this, the plants, having their roots deep in the soil, have plenty of support, and are not so quickly affected by dry weather. The amount of seed varies from 5 to 8 lb. to the acre. When the plants are 6 in. high, they should be thinned out to 3 or 4 in. apart for rich soil, and more space allowed each plant in poor ground. With good, clean, and evenly-graded seed, the sowing may be adjusted so that very little thinning is necessary, thereby saving a tedious and rather expensive operation. The quality of the brush is affected to a very large extent by the manner in which this thinning is carried out. If too much space is allowed, the plants grow very strong and vigorous and produce brush which is coarse and unsuitable for market. On the other hand, if crowded too much they become very fine and weak. To obtain an even crop, it is essential to have uniform sowing and germination, and later on to thin the plants to a uniform distance. Some growers prefer to sow the seeds in "hills," 15 to 20 in. apart in the drills, leaving from six to ten stalks to each. The seed should be covered from ½ to 1 in. deep, the depth depending upon the character and condition of the soil. If it is dry, deeper covering is more necessary than would be the case if the soil were in a good moist condition. Where labour is scarce, several sowings should be made in succession to enable the grower to deal with his crop at regular intervals, and not have the whole area mature at the same time. Rolling the land as the seed is planted ensures a quicker germination and a better stand, particularly if the soil is a little dry. When drilled, the roller at the rear of the machine is quite sufficient. Should heavy rains fall after sowing, and before the seed has germinated, a light harrow should be used as soon as the

condition of the soil will admit. When 6 in. high, the crop may be harrowed to keep the soil loose and to gradually fill in the drills, and thus destroy any young weeds. Broom millet makes rather slow growth for the first couple of weeks, and the cultivator should be kept going every fortnight or three weeks, to keep the surface soil loose and friable, to conserve moisture, and prevent weed growth, and in every instance after rains. For large areas, a two-horse spring tine cultivator may be used. When the crop is half grown, under favourable conditions cultivation may cease; in any case the surface roots must not be disturbed by cultivating too deeply. In moist and exposed situations the crop may be lightly hilled, as an extra support is necessary. It is during the early stages of growth that the cultivator is of greatest value, as the soil may then be loosened fairly deeply. The most critical period is when the heads are forming. If dry weather should set in then, the brush will be short and stunted. It may be necessary in some districts to sow early or late in the season so that the crop will not come into flower during such trying conditions. Where irrigation is practised, it is essential to plant in suitably graded land and convey the water by means of open drills between the rows. After each application of water, and as soon as the nature of the soil will allow, the soil must be well cultivated to prevent caking and to conserve moisture.

Manuring.

On soils that are somewhat poor, it is advisable to apply fertilisers. Such crops as cowpeas, field-peas, vetches, and clovers are suitable for green manuring, and may be ploughed under when they have reached the blooming stage or have been grazed off by stock. This latter system works well when mixed farming is carried out, and stock of different kinds are kept. Any vegetable matter should be ploughed under early, to give it ample time to decompose before sowing. Farmyard manure, if available, is also a first-rate manure to apply, as it not only supplies the elements required by the plants, but also improves the mechanical condition of the soil. Chemical manures are also valuable, and are very easily applied. Superphosphate, bone-dust, dried blood, and sulphate of potash will be found

Plate 27.—A Corner of a Broom Factory, Fortitude Valley, Brisbane.

the most suitable. The quantities used for maize or sorghum will do equally well for broom millet. The following make a complete fertiliser, and may be applied at the rate of 2 to 2½ cwt. per acre:—

Superphosphate	80 lb.
Dried blood	64 „
Bone-dust	50 „
Sulphate of potash	30 „

The manures should be passed through a sieve, to remove lumps and foreign substances that would prevent them from passing freely through the drills. They should be thoroughly mixed just before sowing, as, if mixed any great length of time before required, they are very liable to "set," especially if the weather is at all damp, and this necessitates breaking up and rescreening before use. It is impossible to state definitely what quantity of manure is required for each class of soil. Growers would do well to conduct experiments on a small scale with manure, mixed in varying proportions, and to notice which give the best results. Soils, even in one locality, often vary considerably in their chemical and physical characters, and by such tests the farmer may soon determine the most suitable mixture for his land. An excessive dressing of manure tends to produce a strong coarse brush.

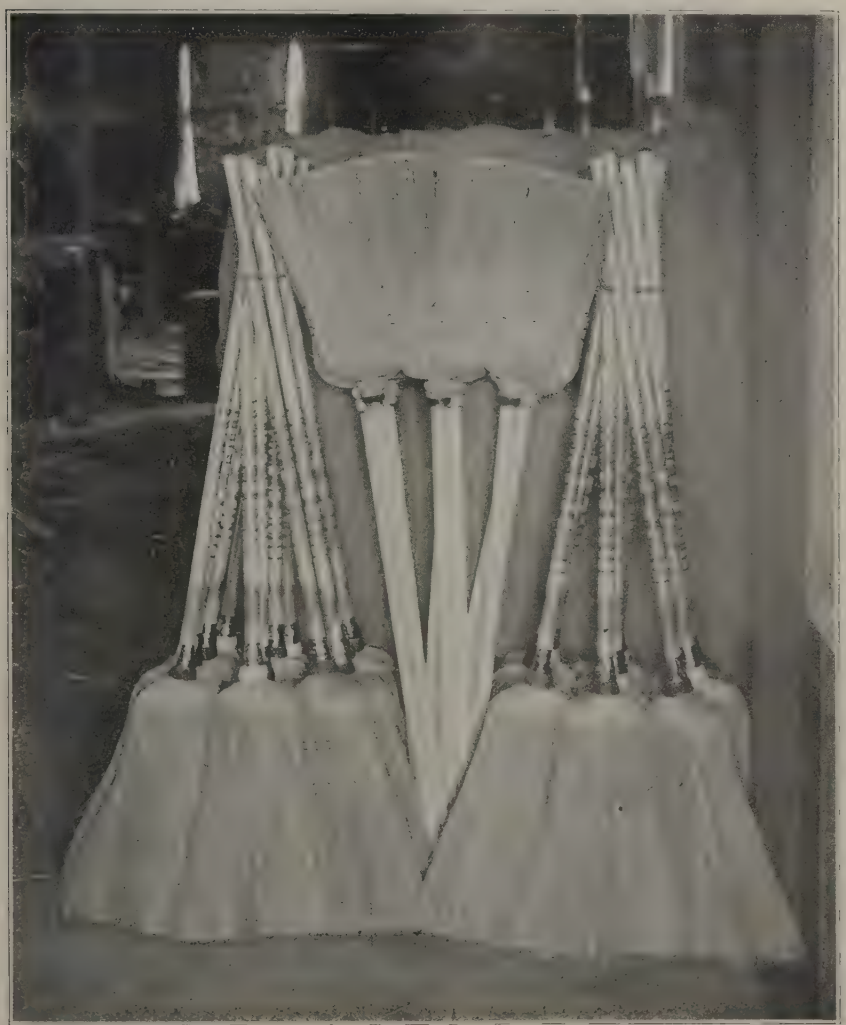


Plate 28.—A Queensland Product—Millet Brooms Ready for Market.

PLATE 29.—BENDING BROOM MILLET AT QUEENSLAND HIGH SCHOOL AND COLLEGE, GATTON.

Bending the Heads Over.

The practice of bending the heads over is not carried out extensively in this State, and as a result a large amount of bent brush is sent to market, which can be used only as "insides" or "covers." In many parts of the United States of America this operation is never neglected. When allowed to grow in the natural way, a large percentage of the brush will spread out, and bend over on account of the weight of the seed, and this reduces its market value. This is especially the case if there is good rain when the brush is forming. The rapid growth causes the panicles composing the head to become tender, and unable to bear the weight of the growing seed. Strong winds, at this particular period, will also cause this, and grain-eating birds, when plentiful, are sometimes responsible for a great deal of damage. The illustrations show examples of the brush thus destroyed.

This loss may be prevented by bending the head over, and the weight of the seed in maturing will cause the brush to lie close and straight. The turning must be done between the joints or nodes, as if done on the joints the stem will snap and the top die off. The bending checks the flow of sap a little, but the growth in the head is not materially affected. This operation is performed when the seed is beginning to fill out, and the brush shows signs of spreading.

It should be understood that it is quite possible to grow millet without turning down the heads. Some of the best millet on the market is grown by farmers who do not favour the operation. At the same time, there are seasons when a fairly large percentage is completely spoilt, and such losses could have been prevented by the adoption of this system. The stalks are bent about a foot below the base of the head, and, if the plants are very tall, there may be two bends, as shown in illustration. The heads should hang clear of the ground, so that they will not be damaged by rubbing, or discoloured by the splashing of mud in rainy weather.

Harvesting and Curing.

No matter what care has been bestowed upon the cultivation of the crop, sound judgment must be exercised at time of harvesting. An excellent crop may be brought successfully as far as this stage, and yet the result be unprofitable on account of inattention to, or ignorance of, some apparently unimportant detail. The time to harvest and the various other operations required to prepare the millet for market are such as require some experience in order to do them properly. Even experienced growers are not unanimous on the point of when to harvest the brush, some cutting the heads when in blossom, and others harvesting later so as to obtain better developed seed possessing considerable nutritive value. The time to cut will depend upon the weather and the colour required. Manufacturers generally prefer a millet having a green tinge. It is then much tougher than when allowed to become nearly ripe. To obtain this green colour the millet should be cut when the seeds are in what may be called the dough stage. The brush is then fully developed, but the grain is soft. For some classes of goods a golden colour is preferred, in which case the crop is left till the grain is fairly firm. With a little experience it is easy to harvest a large area, and yet maintain a uniform tint. A strong knife (a pruning knife is very suitable) is used to cut the brush, and at least 6 inches of stalk should be left on. In dwarf varieties the brush should be pulled instead of cut. Select fine weather for this operation. Some growers bend the stalks of drills towards each other diagonally, about 2 or 3 feet from the ground, forming a sort of platform upon which the cut heads are placed to dry. Others cut the whole of the stalks, and lay the millet upon them.

Drying in the Field.

In this State the millet may be properly dried in the field during the greater portion of the summer months. Should thunderstorms occur, the brush must be placed in heaps and covered with tarpaulins, sheets of iron, or other material. The time required for drying depends upon the season, but still, with fine bright weather, two days should be sufficient. The brush must not be allowed to get wet, as rain or dew soon discolours it.

Drying under Cover.

The finest colour is obtained by drying under cover, or away from the direct rays of the sun. The millet is left a couple of hours in the field for some of the moisture to evaporate before being taken to sheds fitted up with racks one above

the other, so that the brush may be spread out in layers about 3 inches deep. It must be turned regularly at frequent intervals, and when nearly dry may be placed in thicker layers. This method requires plenty of space and a good deal of attention, and it takes longer to dry.

Removal of the Seed.

The seed is removed by means of a hackler.

The machine consists of a roller studded with small iron spikes, mounted in a frame and made to revolve at high speed. A handful of the brush is held so that the roller comes in contact with the seeds, which are speedily stripped off. A firm at Morpeth specialise in millet machinery, and supply these in hand, horse, or belt power for about £4 10s. and £5 10s. respectively.

For small quantities a handy man can very easily make one, but it is best to purchase one, properly constructed, for treating large amounts.

Grading.

The grading of millet is most important, and must not be overlooked. While grading cannot be done so cheaply or expeditiously on the farm as in the factory, still, in the grower's "own interest, it is essential that some grading be done." It should be sorted into at least three classes—"Inside," "Covers," and "Hurl"; and any which cannot be honestly included in any of these classes should be discarded. Green and golden should also be kept separate.

Baling.

The various grades should be baled separately. For this purpose a press is required. One used for lucerne or other hay can be conveniently adapted for this purpose. It is important, especially where space is charged for in freight, to reduce the bulk as far as possible. The brush is laid with butt ends outwards and the heads overlapping in the middle. Battens may be placed on top and bottom of the bales, and when pressed the whole is secured by five fairly stout wires. The size varies with individual growers; but a bale 46 inches by 30 inches by 24 inches, and weighing from 300 to 400 lb., can be recommended. Each bale should be legibly branded with an indication of the quality. There are several styles of home-made presses in use, but one that is coming largely into favour is made on similar lines to a wool-press, having wire ropes and a lever.

Yield.

The yield ranges from 10 to 15 cwt. of clean marketable brush, and 25 to 30 bushels of seed per acre. The price of broom millet fluctuates considerably with the season; and while it may vary from £18 to £40 per ton, the general average for prime hurl may be set down at £30, cover millet at £25 to £30, and inside millet at £20 per ton. Should the prices, however, be somewhat low when harvesting takes place, the millet may be stored for any length of time without deterioration, and disposed of when higher prices are obtainable.

On account of the seed not being properly developed, it is best to consume it on the farm. Its value may be estimated at 4s. per 4-bushel bag.

Selection of the Seed.

Special attention must be given to the selection of the seed. That obtained in the process of stripping should not be used for sowing. The practice of using such would speedily lead to deterioration and the production of inferior brush.

Good reliable seed can only be obtained by sowing in special areas and allowing the plants to mature their seed naturally. Individual plants may be allowed to ripen their seed in an ordinary field, but there is always a danger of them being hybridised by pollen from plants having inferior brush. In any case, seed should be obtained from those which produce the best heads. By proper cultivation and selection the quality and yield of any variety may be improved. Where seed-eating birds are troublesome, it may be necessary to cover the heads with some light material, such as muslin, when the seed is commencing to fill out. The ends must be tied loosely round the stalk so as not to interfere with the free circulation of the sap. After harvesting, the heads are thoroughly dried, threshed, cleaned, and kept in a place secure from weevils and damp.

Where the conditions for saving seed are not suitable it is best to purchase from reliable seedsmen. There are several varieties on the market, but so far White Italian has given the best results in this State. At the same time, growers

are advised to experiment with new varieties from time to time, or introduce fresh strains of those kinds they have in constant cultivation, with the view of finding out what particular kind is most suitable to their conditions.

By-Products.

The object of the cultivator should be to produce brush of the best quality; consequently all other use of the plant must give way to this. In former years millet was allowded to develop a fair proportion of seed, but the diminished value of the brush was not compensated for by the value of the seed obtained. The finest green brush is usually obtained while the seed is in an immature condition, but in the production of good golden-coloured millet a fair proportion of the grain is more or less developed. This contains an amount of nutriment, and can be utilised for the feeding of stock, thus assisting in reducing the expenses of the crop. It is, however, generally more or less soft and doughy, and, if intended to be kept for any great length of time, should be thoroughly dried by spreading out in thin layers on tarpaulins. Growers who insist upon ripening their seed will secure brush of an inferior quality, which brings a low price upon the market, and if exported injures the trade.

Stalks and Leaves.

The plant cannot be recommended as a particularly useful one for feeding purposes. While young a certain amount of sugar exists in the sap, but this soon disappears, and by the time the brush is cut the stalks are more or less dry or pithy, and contain a large proportion of fibre matter which is unpalatable. For this reason very little use is made of them beyond turning stock in after the harvest to feed upon the leaves. The refuse should afterwards be cut up with a heavy disc harrow, or cornstalk cutter, and ploughed under for manure.

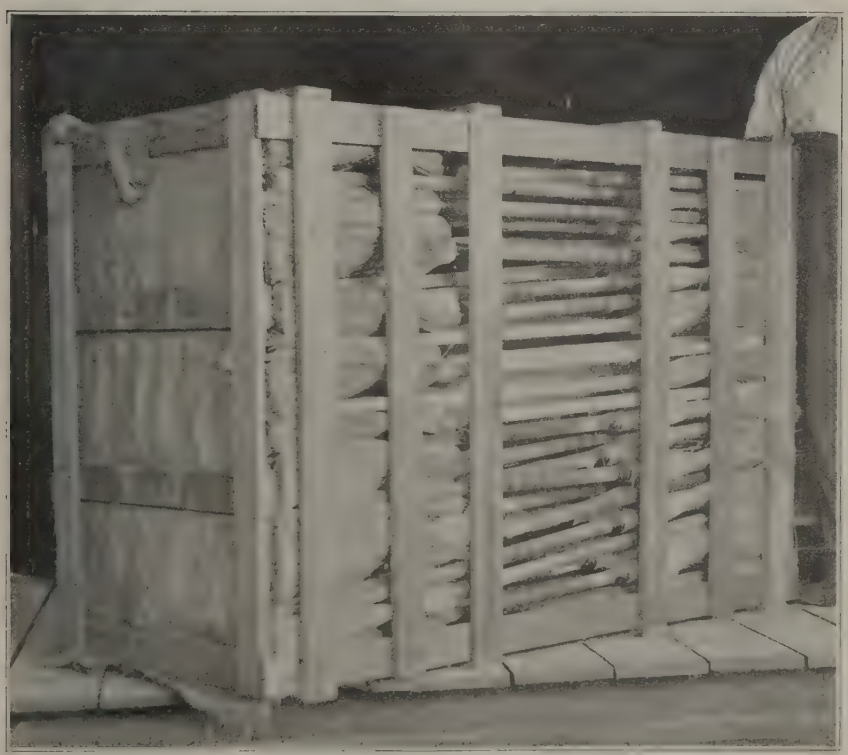


Plate 30.—Queensland Brooms Cased for Shipment.

A FINE TOMATO CROP.

The head gardener, Mr. A. Martin, has grown a very fine crop of tomatoes in the garden at Government House this season. The seed was supplied by Mr. Moore, of Bowen. The plants were put out early in August, they were grown in gravelly soil well trenched, and manured heavily. They had no special treatment, only when the fruits started to swell they were given a good mulching of horse manure. The accompanying photographs give some idea of the crop, and Mr. Martin's trellising method, though they were taken after half the crop had been harvested. Mr. Martin

Photo.: Department of Agriculture and Stock, Brisbane.

Plate 31.—Tomatoes ("Bowen Buckeye") in the Garden at Government House, grown by Mr. A. Martin, Head Gardener.

On the edge of the rows showing method of staking, binder twine would be more economical than wire netting.

advises: "I see by the trials at Bowen, Dennisonia came out on top; by the results here Bowen Buckeye beat it for a heavy crop. These two varieties should suit market gardeners or those with a small area of land, but I should advise them to grow them on single stems, in rows 3½ feet apart and 2 feet between plants.

"A cheap trellis to suit that style of growing—1½-inch hardwood stakes 10 feet apart, 5 feet out of ground, and use binding twine to train the plants on; pick all laterals off, and get earlier fruit and very little wastage. Grown this way one can get about the plants easily for spraying, mulching, and picking."

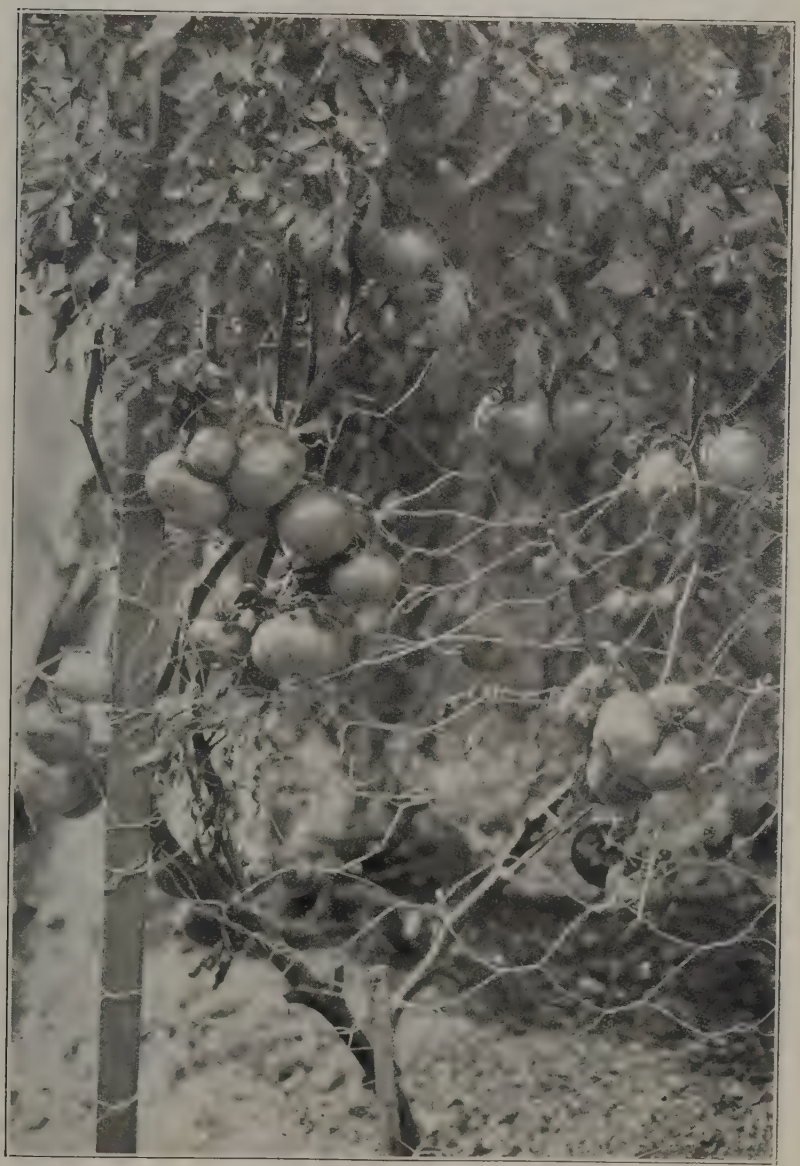


Photo: Department of Agriculture and Stock, Brisbane.]

PLATE 32.—TOMATO DENNISONIA.

A close-up view showing one plant ("Dennisonia") and method of staking. The picture was taken after the plants had been picked over. They were really more prolific bearers than the picture would suggest.

Photo.: Department of Agriculture and Stock, Brisbane.

PLATE 33.—A PLANT OF "BOWEN BUCKEYE"—PORTION OF A FINE CROP IN THE GOVERNMENT HOUSE GARDEN.

SPOTTED WILT OF TOMATOES—WHAT SCIENCE KNOWS OF THE DISEASE.

There are several wilt diseases of tomatoes which are entirely distinct from one another, in that they are caused by different parasitic organisms for which different control measures are recommended. Wilting may be due to the action of parasitic soil-dwelling fungi, or may be caused by a parasitic bacillus. The late blight fungus, as the name suggests, frequently causes blighting or wilting in affected plants.

The spotted wilt or bronzed wilt disease is distinct from all the above troubles. It is well, therefore, not to be misled by the term "wilt resistant" or "blight resistant" tomato, for it generally refers only to a variety which is resistant to the wilt disease connected with *Fusarium* fungus, and certainly does not refer to the other diseases which are at times so destructive under local conditions.

The spotted wilt disease has occasionally caused very severe losses among tomatoes. It is most noticeable in the early crops, but in some years the disease may spread throughout the season. Plants in any stage of development are subject to attack.

The First Symptoms.

The first symptoms appear on the young terminal shoots. Small, brownish discoloured areas develop on the upper surface of the young leaves, and the discolourations spread until the whole leaf is involved. On the slightly older leaflets the disease usually first appears in the form of smooth, greenish-brown spots between the veins. These spots then may extend until the discolourations amalgamate as before. As the disease develops, the affected tissues blacken and shrivel until the shoot appears as though it had been scorched by a flame. Brownish-black streaks may also appear on the surface of the stems and leaf stalks.

Vigorously growing plants seem most susceptible, and sometimes the plant may be killed within the space of a few days. On the other hand, the disease may take several weeks before reaching its full development. Apparent recoveries also have been observed. New shoots may develop from the diseased tissues, and these shoots may grow for long periods before showing the usual symptoms of the disease. The fruits on affected plants usually develop more or less sunken spots, and ripen unevenly. Very young fruits shrivel and fall.

Probably Spread by Insects.

The true nature of the disease is not yet finally established. It is infectious in character, and experiments have indicated that insects are probably the chief agencies in the spread of the disease from plant to plant. All commercial varieties of tomatoes appear susceptible to the disease. The small egg and cherry tomatoes, however, are highly resistant. The disease has also been observed on several other plants belonging to the family *Solanaceæ*.

Tests with seed from diseased tomato fruits indicate that the disease is not carried over by this means. The available evidence suggests that it is carried over from year to year in infected plants—tomatoes or closely related weeds belonging to the same family. Various specifics have been placed on the market with claims that their use results in the prevention and cure of the disease. The vendors of the preparations generally overlook the fact that apparent natural recoveries occur, and that their claims are usually not supported by the results of experimental trials. None of the claims have been substantiated in trials conducted by the Department of Agriculture. The most successful results have been obtained by the use of contact insecticide sprays, consistently applied throughout the season.

Precautionary Measures.

The following precautionary measures will prove of value in minimising losses from this disease:—

1. Remove and destroy affected plants on the first appearance of the disease.

2. Destroy weeds in the vicinity of the crop.

3. Stake and prune the plants.

4. Use insect repelling and destroying sprays, *e.g.*, home-made tobacco washes or commercial nicotine sulphate, and make frequent applications in the early part of the growing season.—A. and P. Notes, N.S.W. Dept. Ag.

CUSTARD APPLE (*ANONA CHERIMOLIA*).

By GEORGE WILLIAMS, Instructor in Fruit Culture.

Under the heading of Anonas are included a fairly wide range of varieties of small trees and shrubs, but it is to those generally known as custard apples that very much interest is attached, and these are of wide distribution. The Cherimoya (from South America) is the most important; others known locally are the "sweet sop" (*A. squamosa*), "bullock's heart" (*A. reticulata*), and the "sour sop" (*A. muricata*). The "sweet sop" was the earliest introduction; a small tree with medium sized, deeply corrugated, many seeded fruit of pleasant flavour. Distributed throughout coastal lands it has adapted itself to local conditions, and in the Cardwell district has been noted holding its own amongst indigenous vegetation. The "bullock's heart" (sometimes applied erroneously to the cherimoya) attains more pretentious dimensions, producing fruit usually heart-shaped, and varying in colour from brownish-red to yellow. Dark brown seeds are interspersed through the pulp, which is not of high quality. The "sour sop" does not thrive under Southern conditions but luxuriates in the far North, making a very handsome symmetrical small tree with dark laurel-like foliage. Its green fruit, weighing up to 8 lb., is covered with soft green prickles, and is freely produced from the time the tree is four years old. The white pulp, which contains the rather small black seeds, has a pleasant sub-acid flavour somewhat resembling pineapple. Under congenial conditions the tree retains its attractive glossy foliage throughout the year. The previous varieties are almost entirely deciduous. On account of its rapid development this variety was suggested as a suitable stock for the cherimoyer in the warmer parts of the State, but results attendant upon its trial were entirely unsatisfactory. The seeds of the cherimoya from which the original Queensland stock was raised were imported from South America. Numerous plants were distributed, showing with development wide variations in vigour, productiveness, and quality, and it is questionable whether so many types referred to as Island varieties were not originated from this source. From a tree showing much advantage in essential features—vigour, habit, quantity, and quality of fruit—in the Brisbane district, the parentage of the most excellent type of custard apples is responsible. Several variations have been claimed but the original has not been surpassed. It is generally catalogued as Mammoth, or Pink's prolific.

A slight diversity in opinion regarding the most suitable soil for the culture of this fruit exists, but agreement is general that a deep soil of good drainage are the primary requisites. The Redlands district possesses the finest trees and is the principal producing area, though quite equal returns from trees of a given age are recorded from granite soil in the Brookfield district. Vigorous growth and reasonable production has attended planting on the Blackall Range, but for various reasons extensive planting is not there recommended. Unfortunately in the South Coast district many trees are included in shallow soils over rather impervious clay. Under these conditions early decay of the trees can be expected. Drainage, friability, and fertility, aided by humus supply, are absolutely essential to successful culture.

Propagation is affected readily by seeds of the more inferior types but in the cherimoya seeds are sparse, and of these quite 50 per cent. may be infertile. Though seedlings of other varieties do not exhibit many variations, those of the cherimoyer are most unreliable, consequently budding or grafting are resorted to. The latter is generally practised by the method known as whip grafting on nursery stock and cleft grafting on larger specimens. Under unfavourable weather conditions (the operation being performed late in winter or early spring with the start of growth) failures are rather frequent in a system which necessitates the removal of the head of the young tree, and better results attend the insertion of the graft at the ground level in the manner known as herbaceous grafting (on account of its being applicable to soft-wooded plants), the head of the stock being removed subsequent to growth of the graft. Budding is only moderately successful, but could with advantage be applied to trees which were unprofitable and which had to be headed back severely and new vigorous growth induced for bud reception. In selecting budwood the more mature parts near the bases of current year's growth is recommended, though success has followed the use of buds from dormant wood on the early stage of stock growth—the budwood being removed—as also for grafting—from the parent tree prior to the rise in sap.

In most orchards, where trees are grown under exactly similar conditions, variations are prevalent in development and production to the extent of suggesting much room for improvement in the selection of both stock and scion. As the selected cherimoya tree attains the largest dimensions it is advisable that seeds of this be planted for stock production, for disparity in growth is the inevitable result of working a stronger grower upon a weaker one. The scions should be

selected from vigorous and most productive branches of the most desirable trees. The usual practice in propagation is to raise the young plants in a seed-bed, where they remain for one season, these being transplanted into nursery rows and budded during the ensuing summer or grafted the following spring. With ordinary care exercised in transplanting failures are very rare, except when trees are prematurely removed, and where this is not responsible for complete failure it is followed by indifferent growth, sometimes not extending beyond a few inches for the whole season and may after twelve months be responsible for the failure of the plant. On no account should the soil in the vicinity of young trees be fertilised at the time of or shortly preceding planting. The young roots are very sensitive and the action following contact with fertilisers has been responsible for many of the failures recorded. The distance apart at which trees should be planted varies according to local conditions—mostly of soil—and where it is improbable that upwards of 30 feet spaces would be fully occupied by developed trees planting is not recommended. Under the most favourable conditions 40 feet is not excessive.

In Messrs. Percivals' "Sunny Grove" orchard at Redland Bay a tree was measured giving a diameter of 36 feet through the branches, and about 38 feet high. It had been pruned prior to the measurements being taken, both the head and outer limbs being considerably shortened. Various trees in this orchard have given an annual return of fully 50 half-bushel cases.

The tree being of rather straggling habit, which is more pronounced in grafted than in budded specimens, systematic pruning must be applied. For the first three or four years this is fairly severe, being modified with increased age according to development. Being of a pliant nature the shoots or branches if allowed to grow unchecked adopt a pendulous or indifferent loose habit with more or less of the extremities resting upon the ground, and where attempt is made to rectify the position by the removal of the lower placed ones the next in succession usually droop and refill their spaces. At planting the young tree should be topped at not more than 30 inches (24 inches is a fair average) from the ground level, and a single fork formed by two lateral branches allowed to grow for the first season, these in turn being shortened to within about 9 inches (dependent on the vigour) of their bases. This is usually followed by two or more shoots from each "arm," two being allowed to remain, and these in turn being shortened to about 12 inches the following season. Similar treatment—the duplication of branches from short "arms"—is applied the following year. Subsequently shortening is less severe and lateral branches may be encouraged, but these should be shortened sufficiently to ensure rigidity and thinned to the extent of preventing overcrowding. Early pruning is considered detrimental, consequently pruning is not entered upon until the first rise of sap in the spring is perceptible. The habit of fruiting differs from that of most deciduous trees in that the fruit is produced on the current year's as well as previous growths.

The fruiting season is extended, but evidently insufficiently so to admit some growers to exercise the requisite care in the selection of mature fruit for market. The practice of allowing immature fruit to spoil sales when expansion is needed is poor policy and directly incentive to diverting purchasers to other lines in which they are not so easily deceived. A really green fruit will not ripen, and it is a direct loss to the purchaser and indirectly to the growers generally; unfortunately the offending grower shares, instead of the whole, but a proportion of the effect of decreased demand occasioned. It is a most simple matter to determine, by the change to paler colour in the interstices between corrugations of the fruit, whether it is sufficiently advanced to ripen, but the persistency of omission in this direction by some growers suggests more than casual oversight and should be dealt with accordingly.

The regular fertilising of fruiting trees is essential, and the following formula is recommended by the Agricultural Chemist:—1 to 3 lb. superphosphate, 2 to 4 lb. meatworks with blood, 1 to 2 lb. sulphate of potash, per tree, according to size and applied prior to spring growth.

Insect pests are seldom present to a serious extent. A small dark-brown beetle destroying the foliage is infrequent and easily combated by arsenate of lead (solution or dust application). Occasionally wax scale appears on the foliage, and soft scale in addition to attaching itself to foliage is sometimes present on the young wood, but with the fall of the leaf both disappear. Mealy bug attacking the fruit may be eliminated by spraying, with force, a nicotine sulphate or spraying oil solution. The most serious disease to which the tree is subject is a type of collar rot similar in effect to that attacking citrus and equally fatal in its result. Originating usually about the ground level, but sometimes several inches beneath it, its presence would not be noticeable until its effect had shown amongst the branches. The remedial measures are clearing away the soil from the base of

the tree as deep as necessary to get well below the decaying bark—well exposing stem and root crowns—cutting clean away all dead or decaying bark and painting over the whole of exposed surfaces with crude lime-sulphur solution or Bordeaux paste, allowing the parts to remain exposed until the hole is refilled by other cultural operations. A tree showing dead ends or branches or decay in any part should be carefully examined for collar rot, in fact it is advisable, particularly in older plantations (though young ones are not immune) to include with annual pruning the examination below the ground level of main stems.

Though practically deciduous the Cherimoya is rather susceptible to frost injury. Under a generous rainfall it develops rapidly in the tropics and is productive at a comparatively early age. Not being a good shipper extensive planting for supplying Southern markets must be confined to the southern part of the State.

CHICKEN-POX OR WARTS.

By P. RUMBALL, Instructor in Poultry Raising.

This disease affects fowls, pigeons, canaries, and turkeys, and is prevalent during the period of November until April, often assuming a very virulent form during such time. The writer has, however, noticed the disease in various flocks in Queensland throughout the year, but at periods other than that stated above it is generally of a particularly mild nature. The trouble is principally confined

PLATE 34 (Fig. 1).—CHICKEN-POX ON COCKEREL.

to young growing stock and it not only, at times, causes serious loss by the mortality of stock, but when an outbreak occurs among pullets just coming into lay it generally causes a false moult, with the consequence of a very much decreased egg yield, and this, at that period of the year when egg values are high. Once stock have been affected with the trouble they appear to be in future immune, those that escape are liable to attack at a later date, but in this case it does not have such a serious effect upon the bird.

The disease is of a highly contagious nature, but different attacks vary in degree of virulence or seriousness. The form in which it will appear in is largely governed by the physical condition of the stock. Weak weedy birds are susceptible to serious attacks, while strong healthy stock have greater resisting powers. The disease with the latter class of bird does not make such progress and is easier to handle. The necessity therefore of keeping growing stock in perfect condition is well illustrated. Good conditions will follow good feeding, rearing, sanitary quarters, and correct housing. The latter question (housing) is possibly responsible for more trouble both in reference to chicken-pox and other contagious diseases, than the collective errors in any two or three phases of poultry management. The majority of breeders are desirous of increasing the numbers of their flocks beyond the capacity of their plant, with the result that as the chickens develop they are considerably overcrowded in their sleeping quarters. This overcrowding prevents a free circulation of fresh air, with the consequence that the atmosphere becomes warm, humid, and charged with carbon dioxide. Birds forced to sleep under these conditions are lacking in resisting power and fall ready victims to any form of disease.

The disease, as previously stated, varies in degree of virulence, it also varies considerably in form but there is one particular feature which is common to all forms. Fig. 1 illustrates the wart-like growth which is common to all forms, this is, however, only a mild case. The mild form of the disease in this condition was probably due to the good development and condition of the bird.

In the early stages of the disease there is generally a slight elevation of temperature, diminished appetite, and a general dulness, but these symptoms are frequently overlooked. After a time slight yellow eruptions or pimples appear,

Plate 35 (Fig. 2).—Chicken-pox—Baby Chick.

varying in size from a pinhead to that of a sorghum seed. This stage is also occasionally unnoticed, and it is not until many of these eruptions have run together and turned a dirty light-brownish colour, that the disease is noticed. From the wart-like growth of the disease in the advanced stage, the term "warts" is taken. The wart-like growths are generally confined to the bare parts of the head, such as the root of the beak, nostrils, angle of mouth, ear lobes, wattles, comb face and eyelid. Individual warts may attain the size of a pea, but there is a general tendency for them to spread from one to another until a considerable portion of the bare part of the head presents a roughened mulberry-like growth as is illustrated in Fig. 2.

When the eyelids become affected they are more or less swollen and closed, and it becomes impossible for the bird to see, with the result that they rapidly lose condition on account of lack of food.

In some forms of chicken-pox there is not infrequently a discharge of a catarrhal nature from the nostrils, mouth, throat, and eyes, canker formation (cheesey like growths) appear at the angle of the beak and diptherietic lesions may also be present. When such is the case there is that pronounced putrid smell of roup, and the disease is in its most serious form.

In mild cases the disease may run its course in a week or two with very little attention, but in the majority of cases the disease progresses, the wart-like growths increasing in size and numbers, the bird becomes emaciated, rapidly so when the eyes are affected, and death ensues from exhaustion.

Treatment.—As chicken-pox is of a highly contagious nature, isolation of sick stock should be practiced to prevent the spread of the disease and to facilitate treatment. A general disinfection of premises and clean-up should follow. A wet mash could be fed once or twice daily containing abundance of good succulent green feed. This could be moistened with milk if available, and at least two feeds a week could contain epsom salts at the rate of 1 ounce to every twenty adult birds or forty half-grown birds.

The wart-like growths could then be painted daily or every second day with any of the following:—

1. Carbolised glycerine; 1 part carbolic acid in 15 parts glycerine. Olive oil may be used in the place of glycerine.
2. 10 grains silver nitrate to the ounce of water.
3. Iodine paint, 5 per cent. solution.

After a few applications, according to the severity of the case, the warts will usually drop off. In cases where there is a discharge from the nostrils and eye they should be cleansed with equal quantities of hydrogen peroxide and water or some mild disinfectant. This is best done by means of a syringe or small oilcan. This could then be followed up by placing a few drops of tincture of iodine, with the aid of a medicine dropper in the eye and up the nostrils.

When canker formations are present in between the beak, roof of mouth, or throat they should be painted with iodine or lightly touched with the carbolised glycerine or silver nitrate solution. Douglas mixture added to the drinking water once or twice a week will also be found to be of advantage.

The Poultry Expert of New South Wales makes the following recommendation for the prevention of chicken-pox, but the period of liability to the attack in Queensland is apparently much longer here than there. Mr. Hadlington states, in connection with the prevention of chicken-pox: "The measures that may be adopted to this end are simple, but they must be commenced at the right time, and they must be faithfully carried out. To be effective, a commencement should be made about the first week in January, and a tablespoonful of flowers of sulphur for the equivalent of every fifty adult birds should be given in the morning mash every third day for a period of three weeks. This should then be stopped and for the next three weeks epsom salts should be added every third day to the drinking water at the rate of one ounce to the gallon. At the end of three weeks stop the epsom salts and return to the flowers of sulphur in the mash, and continue alternating these treatments until the period over which chicken-pox is seasonable is passed."

The protective value of the above treatment in Queensland is not definitely known, but the use of epsom salts and flowers of sulphur will be found to be very beneficial in cleaning up an outbreak of the trouble.

Plate 36.—Mr. P. Rumball, Poultry Instructor,
whose services to the industry are greatly appreciated by Queensland poultry raisers.

EDIBLE TREES AND SHRUBS.

The following note has been abstracted from a reply by Mr. C. T. White, Government Botanist, to a correspondent who sought information regarding trees and shrubs for planting on pastoral country as an insurance against drought:—"The planting of edible trees and shrubs will, in my opinion, be found one of the best methods of combating droughts in the West in the future. Unfortunately, a lot of the very best trees, such as the Mulga and Boree, are of very slow growth and seed is not stocked generally by seedsmen. The same cannot be said, however, of the Kurrajong, and for general planting in the West this is probably among the best of our indigenous trees. Seeds are nearly always procurable from reliable nurserymen, and some can supply large quantities of trees at reasonable rates. Among shrubs, the 'Old Man Salt-bush' (*Atriplex nummularia*) is worthy of cultivation. Seed is often procurable from agricultural seedsmen. Among exotic trees worthy of planting are the Phytolacca or Bella Sombra Tree (*Phytolacca dioica*) and the so-called 'Portugese Elm' (*Celtis sinensis*). Seeds of the former are obtainable from Mr. R. Dick, Peruga, via Ipswich, at, I think, 2s. a large packet. It is drought-resistant and an extraordinarily rapid grower. Seeds of the Celtis are not usually stocked by seedsmen."

WEED TAINT—WARNING TO DAIRY FARMERS.

When unusually dry conditions prevail dairy cows are given to eating plants or shrubs that possess strong odours and flavours which become absorbed in the milk and products therefrom. Recently samples of milk, cream, and butter possessing a strong disagreeable smell and flavour have been submitted to departmental officers for investigation. A sample of the plant eaten by cows producing such milk was submitted to the Government Botanist for examination and report. The analytical report showed that the butter was normal, while the bacteriological examination of the milk and cream showed evidence of clean milking methods and the use of clean utensils. The Government Botanist identified the plant submitted as *Rivina Lævis*. It would be advisable where this plant has been identified that immediate steps be taken to eradicate it.

The following full report on the plant by Mr. C. T. White, Government Botanist, is reproduced for the benefit of dairymen unacquainted with it, from the "Journal" of March last:—

RIVINA (*RIVINA LÆVIS*).

Description.—A slender, branching plant 2 to 3 feet high. Leaves on long stalks of ½ to 1½ inches. The leaf itself (blade) ovate-lanceolate in shape, variable in size, 2 to 5 inches long, ¾ to 2 inches wide, dark-green above, paler beneath, veins raised underneath. Flowers small, in slender racemes in the forks of the branches, at first only 1 inch long but lengthening in fruit to about 4 inches; the flowers themselves white tinged with pink, about 2 lines across. Fruit at first white, then pink, and finally a bright red when ripe, fleshy, about ¼ inch in diameter, filled with a red, watery juice and containing a single seed; seed black, about 1 line across, covered with short rather scattered bristles.

Distribution.—A native of Brazil. In Queensland it is found as a weed in coastal localities from Brisbane northwards to the Atherton Tableland. Generally speaking, it occurs along scrub tracks and edges, along fences, &c., where it can get partial shade.

Common Name.—In Queensland, owing to its property of tainting milk, it is sometimes known as "Stinking Weed," a name, however, applied to several strong-smelling plants.

Botanical Name.—Rivina, in honour of Dr. A. Q. Rivinus (born in 1652), for a long time Professor of Botany and Medicine at Leipzig; *lævis*, Latin, meaning smooth, in allusion to the smooth stems.

Properties.—In the "Queensland Agricultural Journal" for February, 1924, Mr. F. J. Watson, Instructor in Dairying, has a note on this weed.*

He states: "The attention of dairymen is called to a weed or shrub which is at the present time a frequent cause of a very serious defect in cream. This plant is not usually eaten by cows, but sometimes in time of drought one or more cows of a herd will take a liking to it, with the result that if their milk is mixed with that of others the whole becomes tainted. The taint is abominable, and is so penetrating that the cream from the milk of a single cow fed on the plant will taint a whole vat of cream and the butter made therefrom; and as cream so tainted is unfit for human consumption, it behoves dairymen to be on the lookout for cows addicted to the habit of eating the weed, and to exclude their milk from use for dairy purposes. . . . . Cows that eat the plant are easily distinguished from others by the fact that their milk tastes and smells of the plant, and their excreta give forth a very unpleasant odour."

The plant has several times been received for identification with the report that it gave a very unpleasant odour to the milk of cows that fed on it.

Eradication.—On account of the sheltered position in which the plants grow, hand-pulling or hoe-chipping is the only satisfactory method of eradication.

Botanical Reference.—*Rivina lævis* Linn., Mant., p. 41.

*The weed is referred to an allied plant *Monococcus echinophorus*, but there is no doubt that from his description *Rivina lævis* is the plant referred to, a mistake having arisen in some way. *M. echinophorus* is a scrambling or semi-climbing shrub with burr-like fruits.

Plate 37.—Rivina (Rivina lævis).

ARE QUEENSLAND WOOLS DETERIORATING?

By W. G. BROWN, Instructor in Sheep and Wool.

For some time I have been receiving letters asking that I should say something regarding merinos, especially those of the men possessing from 2,000 to 5,000 sheep. I shall first give a short review of the merino in Queensland from the beginning, and then show how any man can improve his flock. In discussing the above it is necessary to go back into somewhat ancient history to obtain data.

In regard to the average weight of fleeces per head, it is doubtful if it has increased materially during the past 25 years. There is, however, not the least doubt that the modern sheep carry very nearly double the weight of clean scoured wool than was carried say in the 70's and 80's. It is nearly 80 years ago since the late Frederick Bracker brought a flock of sheep to Queensland. The North British Australian Investment Company stocked Rosenthal and Toolburra in the Warwick district with sheep. They were all Saxony type of sheep, superfine wool, comparatively small bodies, and a short, true clothing.

For several years (1892 to 1896) I handled descendants of these sheep at St. Ruth, Dalby, and the average weight of fleece was about 5 lb. greasy. The clean scoured yield was not more than 2¼ lb. in any estimate. The wool was heavy with yolk, with a heavy black shotty tip. No lambs were ever shorn as the wool was too short.

The late Mr. John Matheson, one of the best sheepmasters I have known, and who had been in the employment of the N.B.A. Company for over 50 years, was manager. He informed me that the St. Ruth fleeces were heavier than those on Rosenthal and Toolburra. The average weight of fleeces when the wool was washed on the sheep's back was about 2 lb. The N.B.A. Company's sheep I take as a typical example of the kind carried generally on the Darling Downs, where the first sheep were installed in Queensland.

Up till well on in the 70's the fine short wools prevailed. From that period they have been ousted from Queensland by the Rambouillet type, otherwise the Wanganella, with a good infusion of the Tasmanian merino.

The Saxony type were utterly unsuited to Western conditions. The super-fine wool of the Downs degenerated into cobweb and the animals were found to be unable to withstand hardships of any kind. There is not a single flock of the old time Steigner and Gadigast Saxony merino to be found to-day.

Introduction of Wanganella Sheep.

The introduction of the Wanganella or sheep allied to the Peppin and Webber Rambouillets altered all that. The weight of fleece was doubled, and the animals proved to be able to withstand hardships as no other has done. The Vermonts intruded for a few years, but for similar reasons as with the Saxony type they are now utterly discredited. It is perhaps a coincidence, but the advent of the wrinkled fatty-woolled Vermonts was followed by the blowfly pest. The Saxony wool, of course, brought many pence per lb. more than the Wanganella and its congeners, but this was far more than made up for by the increased weight of fleece, size, and robustness of constitution. Yet the Saxony type left its mark; it transmitted beautiful character, softness, and a certain fineness, which the ancient Rambouillet did not possess to a very great degree.

One of the questions I am asked is has merino wool deteriorated in Queensland? I am of opinion that, generally speaking, it has not. In the Departmental wool room there are many examples of Queensland-bred wool. These were collected for the Dunedin Exhibition, and were recently returned. They are all good, but several fleeces stand out on their own. Two or three of them, bred in the Central District, cannot be excelled anywhere. Mr. Millear, of Deniliquin Stud Park, a great breeder of the Wanganella strain, came up to the Departmental exhibit at the last National Show. I pulled several fleeces out for him to examine closely, and he told me that for style, weight, and quality they would be hard to beat anywhere.

As to Queensland wool deteriorating or otherwise a flat rate of 15½d. per lb. was paid by the British Government during the war for every pound of wool produced in the Commonwealth. The flat rate of 15½d. per lb. was exceeded on Queensland wools by over 1d. per lb., Tasmania by ½d., all the other States showing less than those figures. Of course, Tasmania had only comparatively small production as compared with Queensland. Queensland thus heads the Commonwealth in price per lb. At a Bradford inquiry two years ago, Queensland wools took pride of place in almost every respect.

Looking Back Forty-three Years.

I can look back to 1883 and say without hesitation that the best Queensland wools have not gone back. It remains to inquire in what way the general average can be raised, even if only reasonably near to the best. There is no reason, I think, why a man with four to five thousand sheep should not possess a first-rate flock of sheep quite as good as most stations, other than stud stations. This applies not only to quality, but weight of fleece.

Plate 38.—Mr. W. G. Brown, Instructor in Sheep and Wool, whose services to the pastoral industry are appreciated by Queensland sheep men.

Sheep Classing.

A few hints to beginners on sheep classing may be useful to the smaller holder, and are here reproduced. It may encourage a beginner to know that there is nothing to stop him from becoming the owner of a flock of first-class sheep, given that he possesses common sense. Of course there must be natural aptitude and liking for the vocation, these factors being essential to success in any business.

On the other hand, there is no royal road to success in the calling; unremitting care and observation, plus hard work, being most necessary. This article contains nothing severely technical, being for beginners. It proposes to give a method by

which a selector may, by using his common sense, bring an indifferent flock up to the level of the best, even if to begin with he has little or no exact knowledge of sheep or wool.

The method is a simple application of the Darwinian theory of "evolution by selection," which is defined thus:—"Pure selection, operating on material which is not the direct result of a cross, modifies the animal or plant, and leaves it different from what it was when selection began. . ."

It was by this method that every one of the great studs of Australia was established. The sheepmen of sixty or seventy years ago, starting with little or no knowledge of the merino, and with what we would now call most unpromising material, have, with the assistance of good, natural conditions, made available to the present generation types of merinos which are the admiration of the world. They worked day in and day out among their flocks, until they knew every individual animal, its excellences and its defects. By selection and combination, often with different ideals, the historic flocks were established, and now Australian wool is a synonym for all that is excellent in that staple. The nations come to us for their fine wool; they copy Australian methods of working; and, as the South Africans are now doing, are paying very high prices for our best sheep.

Sheep-classing is another name for selection. The best ewes are selected from a given flock, and rams are selected to join them, so that the progeny shall retain the good qualities possessed by their parents, or better them.

It is not necessary that every sheep-breeder should become a stud-master in the highest sense. There are many old-established flocks wherefrom to draw good animals for flock purposes, but it is certainly desirable to make an indifferent flock a very good one, and it is within the reach of most to do so.

The Small Flocks.

Coming from the general to the particular, we shall assume that the selector possesses, say, 3,000 ewes of average quality. As, in the great majority of cases, these will consist of good, indifferent, and bad, in varying proportions, which can only be determined by inspection or classing, how shall the owner know which is good, indifferent, or bad? "Goodness," of course, is relative. One man's best may be only second-rate in another's flock, but we shall assume that in this case his best ewes shall be the biggest-framed ewes he possesses. That quality is easy to recognise by inspection. But it is possible that the biggest-framed ewes are so badly covered that it can be seen by the tyro that relatively it is badly covered. With these two factors, then, begins and ends his knowledge of sheep as they stand in the yard—*i.e.*, size and covering. He can say of this sheep, "It is big," and of that, "It is small," and of another, "It is badly covered." What shall he do next? He must wait until shearing time, and then, whatever other work may call, he must stay on the board where, say, four shearers are taking off his clip. He knows a big sheep, or at least a relatively big sheep, and he knows a small sheep. He will have an opportunity, in the ten days or so while the ewes are being shorn, of seeing each animal in detail. He will see that although his flock has been running on the same country for the past twelve months, some big, bright fleeces, weighing as much as 8½ lb., and possessed of big frame. He will see also fleeces dull, short, and dirty on big-framed sheep, and will also see undersized animals with poor fleeces, and between these average sizes with average fleeces.

Obviously his big sheep with the big, bright fleeces, are his best sheep, and the small sheep with bad fleeces are his worst. Let him take his brightest and biggest, and putting a distinguishing earmark on them, call them his No. 1 flock. His worst he shall never use again, but shall fatten them if possible and sell them as mutton, for they are an encumbrance, and a danger to the well-being of his flock. All between he shall call his No. 2 flock. He shall buy good rams, and select the best of these for his No. 1 flock.

He may make a few mistakes at first, but as he acquires confidence in his ability to judge of the weight of fleece and its brightness, he will make fewer and fewer mistakes.

In a few years he will have found that his No. 1 flock has become the apple of his eye, and that he is constantly watching his sheep to promote or degrade as he learns which are really good in either flock, and gradually his No. 1 rises in quality and numbers, and his ideal rises with it too, until at last he has a flock worth owning. Besides that, he will have acquired much comparative knowledge by watching and learning from his neighbours.

The above is not a fancy picture of what a man may do and learn. I knew a man who took up a selection twenty years ago in Western Queensland. At first he knew little or nothing of sheep, but by practising in much the same way as I have indicated he became, in a comparatively few years, a man whose opinion on sheep matters was worth having, and to-day he has a flock which anybody would be proud to own.

Be on the Board when Shearing is going on.

Observe: It pays a sheep-breeder to be on the board while shearing is going on. His harvest is being gathered, and the results of twelve months' solid work and expense are at stake. It is the only opportunity which he will have of seeing his sheep in detail, which is impossible at any other time. He will learn, what is obvious surely and yet is not generally acted upon. I have found that the sheep which does best on any particular country is the best kind of sheep for that country, and if a sheepman takes his best ewes and puts better rams to them his flock must improve, until at last he is either at or near the top. He must always dispose of his culls. He must remember that the stud-masters of old had greater difficulties than he. Yet, look at their works. He must exercise care, watchfulness, and common sense, and besides these a constant asking of questions of successful men in his district. He must remember that the man who knows all about sheep knows nothing; and, finally, he must not overstock when he learns the capacity of his country, for

Feeding and weeding
Is the secret of breeding,

which are the elements of sheep-classing, alias "selection."

AGRICULTURAL ECONOMICS.

DEPARTMENTAL COMMITTEE APPOINTED.

The need for stimulating economic thought in relation to agriculture is becoming more and more evident, particularly in view of the present position, in all its complexities, of rural industry. The economics of agriculture have not up to the present stage in our development received very much attention, the efforts of the Department of Agriculture and Stock being restricted more or less to instructional, cultural, and field experimental work.

Speaking on this subject recently, the Minister for Agriculture and Stock, Mr. W. Forgan Smith, said that in Queensland in recent years, as a consequence of a more direct system of agricultural organisation, which has been encouraged by the Government and strengthened materially by appropriate and comprehensive legislation, farmers have come to recognise more clearly the economic forces with which they have to deal both on the farm and in the market place. Within the last decade or two remarkable progress has been made in our field practice and technical processes and, though we have made an extraordinary advance on what may be called the technological side of production, on the economic side it is almost a case of "as you were." In all agricultural countries it has been discovered within recent years that closer attention must be given to the economics of agriculture. In this respect Queensland is not an exception, and we have just got to that stage in our agricultural development when further progress must be directed along lines of scientific economic inquiry.

In view of the projected extension of closer settlement in certain areas of the State, the advantage of a complete survey of the economic facts affecting farming in those particular districts is recognised. In all cases where people set out to make a living from the land it occurs, regardless of the class of farming they intend to pursue, that there must be some basic factor of acreage necessary to cultivate for any particular crop, and the volume of production required in order to ensure the settler reasonable prospects of success. A consideration of one or more basic factors may be necessary in order to give prospective settlers some indication of the lines on which they should plan and general guidance in their enterprise.

It is considered that among the officers of the Department of Agriculture and Stock there are men capable of making such an economic survey, and informing the Minister of the basic requirements in land and stock for any specific purpose in any particular district.

Accordingly a Departmental Committee has been appointed to carry out such an economic survey, consisting of Messrs. E. Graham (Under Secretary, Department of Agriculture and Stock), L. R. Macgregor (Director of Marketing), H. T. Easterby (Director of Sugar Experiment Stations), H. C. Quodling (Director of Agriculture), M. B. Salisbury (Land Commissioner) representing the Lands Department. Mr. J. F. Reid, Editor "Queensland Agricultural Journal," will act as Secretary. The Committee will have power to co-opt other departmental officer whose services may be required from time to time.

Photo.: Underwood & Underwood. PLATE 39.

This is a photograph of the fine old Black Hamburg vine at Cumberland Lodge, Windsor Great Park, which supplies the table of King George of England. Some of the bunches weigh four and five pounds and many of the choicest clusters are sent to the hospitals and other public institutions. The vine was planted about 150 years ago, is of enormous size, and has covered of 3,600 feet.

AN AGRICULTURAL SURVEY.

COMMITTEE OF EXPERTS APPOINTED.

A commencement of the agricultural survey of Queensland is imminent, and the committee of experts by which it will be controlled has been appointed as follows:—

Mr. E. Graham (Under Secretary for Agriculture), chairman.
Professor H. C. Richards, D.Sc. (University of Queensland).
Mr. H. C. Quodling (Director of Agriculture).
Mr. R. Veitch (Government Chief Entomologist).
Mr. J. C. Brünnich (Government Agricultural Chemist).
Mr. C. T. White (Government Botanist).
Mr. F. B. Campbell Ford (Acting Surveyor-General).

The appointment of the committee was announced by the Minister for Agriculture and Stock (Mr. W. Forgan Smith) recently, when he also said that it was intended that a meeting of the committee would be held at an early date, and that included in its early work would be the formulation of a basis of operations.

It was not considered necessary that the committee should personally engage in the field work that would be involved in the survey, and that phase of the investigation would be delegated to technical officers attached to the Department of Agriculture and Stock.

Scope of the Survey.

Amongst the matters involved in the agricultural survey would be:—

(*a*) A close study of the formation of the soil.
(*b*) The character of the soil and subsoil.
(*c*) Climatic conditions, rainfalls, temperatures, &c.
(*d*) The vegetation now in evidence.
(*e*) The insect life present.
(*f*) The class of agricultural products that can be economically grown in each zone.
(*g*) Facilities for marketing produce.

The foregoing included what might be regarded as the major matters for investigation. Of course, it might be found necessary to add to these from time to time as the work, which would extend over a considerable period of time, developed.

Mr. W. Forgan Smith added that it was proposed that the starting point would be in the coastal and hinter lands north of St. Lawrence, and the survey would ultimately encompass practically the whole of the State.

As a result of the data that would be made available from these investigations, it was expected that a large amount of fertile land, at present non-productive, would be brought under agriculture. It was obvious that a further extension of the sugar-growing areas was not practicable, but, on the other hand, there were certain agricultural products of a tropical and semi-tropical nature that were imported in large quantities into the Commonwealth, and if it was found that the soil and climatic conditions of Queensland were suitable for their production a serious attempt would be made to encourage the growth of these articles in Queensland.

The appointment of the committee has been generally well received by all interested in agricultural progress in Queensland, and the subjoined editorial, taken from the "Telegraph" (Brisbane), of the 7th January, may be regarded as typical informed comment:—

Taking Stock.

"The Minister for Agriculture has now announced the personnel of the committee which is to undertake the survey of the agricultural possibilities of Queensland. It will be seen that it is an eminently practical body of technical experts and scientists, who, between them should be capable of outlining definite developments which can only be made apparent and safe to follow in the light of a fuller understanding of many things on which the average settler is almost necessarily ignorant. Hitherto progress has been more or less haphazard and accidental. Science has now opened many doors that were formerly closely sealed, and it is possible to do systematically and with certainty what has been experimental. The essential thing now is to place the State in a position to take full advantage of that knowledge, and the agricultural survey will canvass the natural resources of the State in the matters of soil, climate, rainfall, possibilities of intensive culture, and evils to be avoided

and overcome. With all that knowledge reduced to well-arranged data, the agricultural production of Queensland will be in a position to forge ahead with much greater security in the matter of successful crops, and greater variety of crops. The scheme fits in admirably with the important educational development which is to be inaugurated in March with the founding of a Faculty of Agriculture at the Queensland University. The State will be in a happy position to make use of the training which will result from the new course, and if only this concentration of attention upon land interests produces a corresponding stimulation of settlement, we shall see an end of the unfortunate dimunition of selection and production which has marked the last few years of Socialist control, though no expectations in that direction can be fully realised until freehold tenure is restored."

UTILITY POULTRY STANDARD.

Type; Colour (plumage and lobes); *Legs and feet* (colour); *Condition*—Health, furnishing brightness and cleanliness of feather and legs; in accordance with the accepted standard of the breed.

LAYING CHARACTERISTICS, ANY BREED.

Conformation—

(*a*) Length, depth, width, proportionate to type of breed.
(*b*) Length as taken from base of the neck to base of the tail.
(*c*) Depth to be determined by the vertical space between the back and the breast-bone and the pelvic bones.
(*d*) Width as measured across the saddle and immediately behind the wings as is indicated by the distance apart of the legs.

Freedom from Coarseness—

(*a*) Shanks strong, as differentiated from either extreme coarseness or fineness of bone.
(*b*) Pelvic bones strong at base; long, fine, and straight.
(*c*) Tissue—pelvic bones to be as free as possible from gristly covering.

Head—Finely modelled; skull deep over eyes, full and round at back.

Eyes—Full, bright and expressive.

Face—Bright, lean, free from feathering, and not sunken.

Comb and Wattles—Neat, fine in texture and medium size, avoiding "beefiness."

Neck—Fine and fairly long.

Skin and Abdomen—Texture of skin to be of the thinnest and finest quality and pliable; abdomen to be elastic, avoiding sagging in, or fullness indicating excess of fat.

Plumage—Feathers soft and silky, close, but not hard as in game; fluff moderate.

Weights—Light breeds, ½ lb. to 1 lb. above minimum and heavy breeds 1 lb. to 1½ lb. above to score maximum points; if in excess to be cut correspondingly.

MINIMUM WEIGHTS.

LIGHT BREEDS.

Leghorns, Minorca, Andalusians, Spanish, Canpines, Buttercups, Anconas: Cockerel, 5 lb.; pullet, 4 lb. Hamburg: Cockerel, 4 lb.; pullet, 3 lb.

HEAVY BREEDS.

Orpington, Plymouth Rock, Rhode Island Red, Sussex: Cockerel, 7 lb.; pullet, 5 lb. Langshangs, Wyandottes: Cockerel, 6 lb.; pullet, 4½ lb. Any other variety: Cockerel: 7 lb.; pullet, 5 lb.

SCALE OF POINTS.

Standard points—Type, maximum points, 20; colour (plumage and lobes), 7; legs and feet (colour), 3; condition, 5.

Laying Characteristics.—Conformation (indicating stamina and capacity), maximum points, 20; freedom from coarseness, 5; head, 7; eyes, 7; face, 6; comb and watties, 5; skin and abdomen, 5; plumage, 5; weight, 5; total, 100.

Disqualification.—Under weight, wrytail, any indications of impurity of breed, dubbing and faking.

INSECTS AND THEIR RELATIVES.

By ROBERT VEITCH, B.Sc., Chief Entomologist.

Insects belong to the extremely important group or phylum of the animal kingdom known as the Arthropoda. The great majority of described species of animals are included in that group and its members occur in salt water, in fresh water, and on dry land. The group includes insects, lobsters, crayfish, crabs, shrimps, woodlice, centipedes, millipedes, scorpions, spiders, ticks, and mites.

Many of these small animals differ from each other very considerably in structure. There are, however, a number of fundamental characters in which they all agree, and a combination of several anatomical features, common to all the animals just mentioned, justifies their formation into one large group and also serves to separate the members of that group, *i.e.*, the Arthropoda from all other animals.

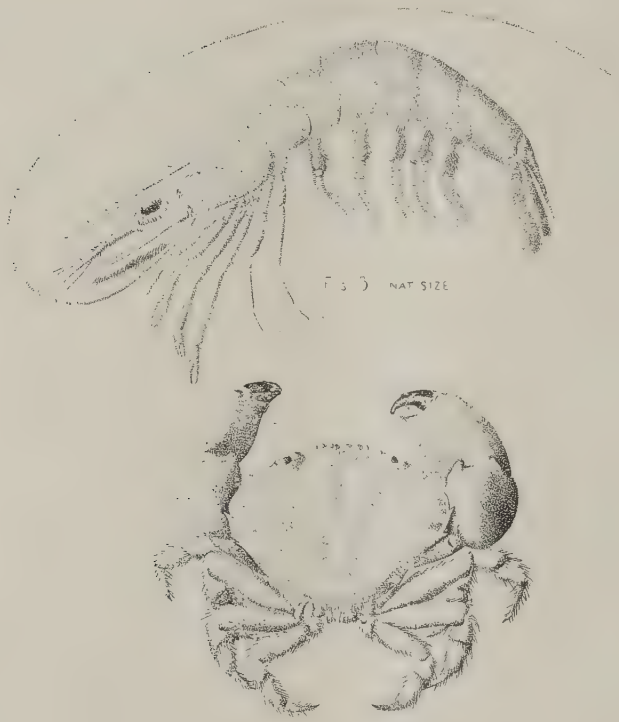
Even a casual examination of a typical Arthropod reveals some of these distinctive features. Perhaps the first point observed is the fact that the body consists of a series of segments or pieces each of which very frequently bears some degree of resemblance to its neighbours. These segments are placed one behind the other, and the division between any two is generally rather clearly marked in at least some portion of the body. The Arthropod body bears a variable number of paired jointed appendages, while a further typical feature is the chitinous external skeleton protecting the soft internal tissues of the body. Chitin is a somewhat horny substance secreted by certain layers of cells in the Arthropod body, and its presence in the cuticle, or outer skin, which it permeates, results in the production of the typical hard outer skeleton. The existence of this external skeleton accounts for the peculiarity that, after death, there is apparently no decay; decomposition of the internal tissues nevertheless does take place and eventually only an empty shell is left. This empty shell is, however, invaluable to the entomologist and zoologist for purposes of classification and identification. A further characteristic feature of this group of animals is the fact that the body is bilaterally symmetrical, *i.e.*, it is evenly developed on both sides.

A bilaterally symmetrical body bearing paired jointed appendages and composed of a series of segments with a chitinous outer skeleton may therefore be regarded as the main distinctive external features of the Arthropoda.

Having drawn attention to some of the more easily observed structural characters that serve to separate the Arthropoda from the rest of the animal kingdom, consideration may now be given to a brief preliminary outline of the anatomy, habits, and economic status of certain of the more important classes of the group.

Lobsters, Shrimps, Crabs, Crayfish, Prawns, and Woodlice.

The Crustacea, the first class to which reference will be made, are represented by lobsters, shrimps, crabs (Plate 40; fig. 1), crayfish, prawns, and woodlice, and are almost entirely aquatic, being mainly marine. The woodlice (Plate 40; fig. 2) are, however, exceptions to



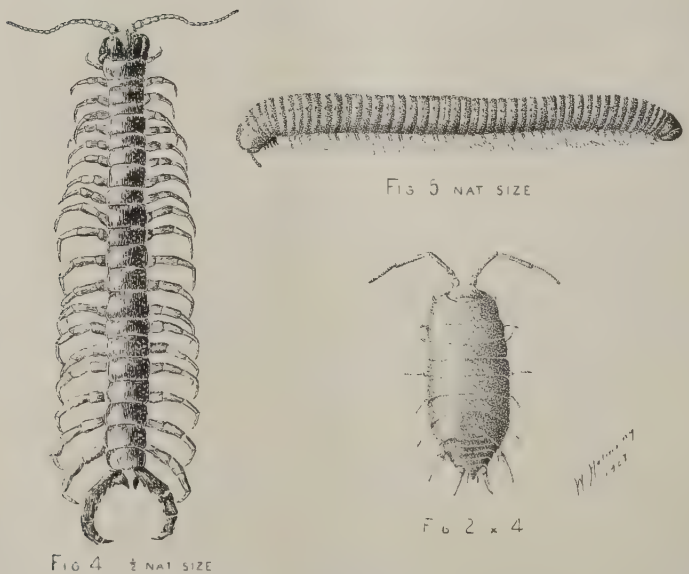


Plate 40.—Fig. 1, Crab; Fig. 2, Woodlouse; Fig. 3, Prawn; Fig. 4, Centipede; Fig. 5, Millipede.

these aquatic habits, being land forms commonly found in damp localities where they frequent the undersides of stones and boards and the damper clumps of heavy vegetation in gardens and fields. Decaying vegetation is generally regarded as the normal food of woodlice, but numerous instances have occurred where they have fed on the roots and foliage of small plants and also on edible mushrooms; they are thus of some slight economic importance. Some of the Crustacea, *e.g.*, the crayfish and the prawn (Plate 40; fig. 3) are of value as a source of food for man.

Crustacea are generally regarded as performing, in fresh and salt water, practically the same functions as those with which insects are associated on land, *i.e.*, some are feeders on vegetable growths, some are predaceous on other animals, while many act as scavengers.

Many species of Crustacea breathe by means of gills, but respiration in the smaller species frequently takes place through the whole body surface. Two pairs of antennæ or "feelers" are present and the body is furnished with a variable number of pairs of jointed legs. The body segments in the higher Crustacea are grouped into two regions—namely, the cephalothorax or head-thorax and abdomen.

Centipedes.

The centipedes or Chilopoda, unlike the previous class, live on land, although a few abnormal species frequent the shore where they are regularly submerged by the tides. They are active fierce animals that are but little seen owing to their secretive habits; they may be frequently found, however, by turning over stones or heaps of leaves or by tearing the bark off rotting trees and stumps. They cannot be regarded as being of any very appreciable economic importance, although in some cases they may be slightly beneficial by virtue of their habit of feeding on other small animals. Unfortunately, however, they are capable of inflicting an unpleasantly poisonous bite and are therefore not unnaturally regarded with considerable feelings of aversion.

The somewhat soft centipede body (Plate 40; fig. 4) consists of two sections only, namely, the head and trunk, the latter consisting of a series of practically identical segments, which in some species number well over a hundred. The whole body has a rather flattened appearance, and although most of the species are long and slender some are short and broad. A pair of many-jointed antennæ or "feelers" is present on the head, the minimum number of antennal joints being generally regarded as fourteen. Each typical body-ring or segment bears a pair of legs, the first pair being modified to form poison claws; large poison glands are situated at the base of the claws, the poison being conducted from the gland to the wound through a canal in the claw. Centipedes breathe by means of air tubes ramifying throughout the body tissue.

Millipedes.

The third class of which mention may be made is the Diplopoda or millipedes. These small animals in some respects closely resemble the centipedes, and like them, they are inhabitants of the land and breathe by air tubes. The millipede head possesses a pair of seven-jointed antennæ and its body (Plate 40; fig. 5) consists of

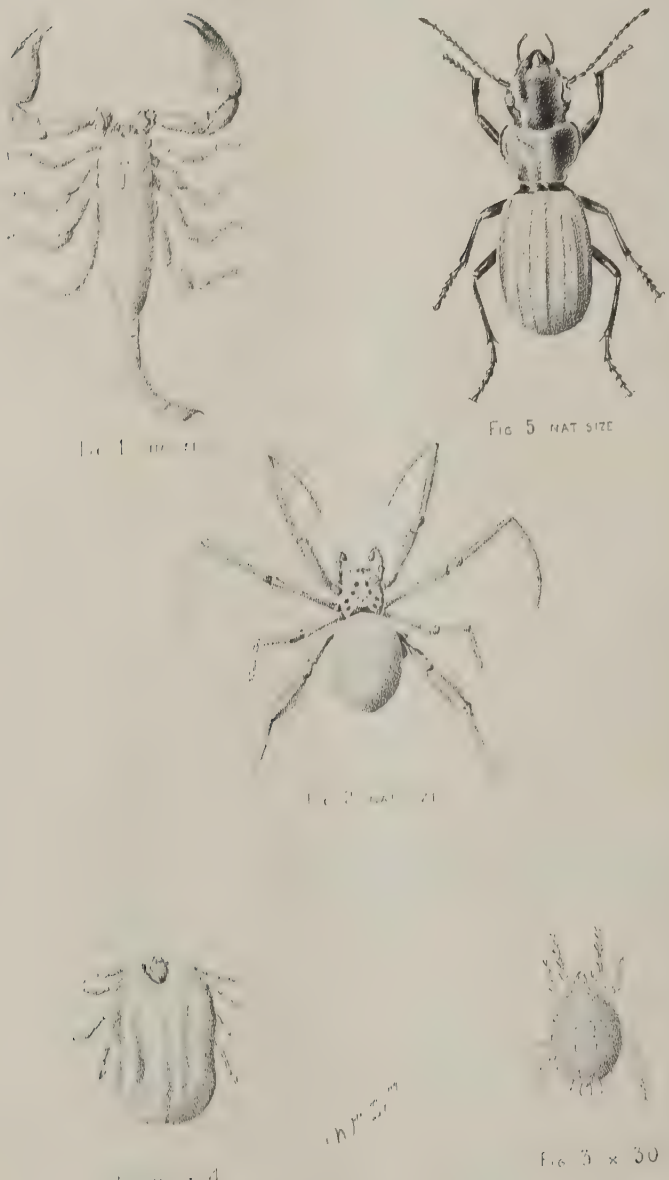


Plate 41.—Fig. 1, Scorpion; Fig. 2, Spider; Fig. 3, Mite; Fig. 4, Tick; Fig. 5, Insect.

a series of segments which are all practically alike in appearance. The segments in this case are distinctly cylindrical and as a consequence the general appearance of the millipede is somewhat different from that of the broader, flattened centipede. The body segments in the millipede are somewhat imperfectly separated, and hence, with a few exceptions, each "segment" bears two pairs of legs; there is, however, still a good deal of obscurity and uncertainty with regard to this feature of millipede anatomy. There is no modification of legs to produce poison claws, but special glands exist for the production of a particularly offensive fluid. There is a high proportion of lime salts in the external skeleton of this class of Arthropod and its skeleton is much harder and tougher than is the case in the centipedes. As in the centipedes, the body is divided into two sections only, namely, head and trunk.

Millipedes are generally supposed to live on decaying vegetable matter, but some species have been recorded as attacking potato tubers and the roots of plants. They are, however, of but trifling economic importance and generally live up to their reputation as quite inoffensive creatures.

Spiders, Ticks, Mites, and Scorpions.

The fourth class to which reference must be made is of decidedly greater importance to mankind than the three just discussed in that it includes the spiders, ticks, mites, and scorpions; this class is known as the Arachnida.

The Arachnida are found almost exclusively on land, and characteristically possess four pairs of legs, but no antennæ. Generally the segments of the body are grouped into two sections—namely, the cephalothorax and abdomen. Respiration may be by air tubes, by lung books, or even through the surface of the body; the name lung book is derived from the fact that these respiratory organs are leaf like in structure. Blood from all parts of the body is carried to the lung books, where it is purified and is then ready to be carried back to the various tissues and organs. Spiders possess the ordinary air tube system but are also supplied with lung books, while in the scorpions respiration is by means of four pairs of lung books; in the ticks and mites respiration is generally by the simple air tube system, although in some of the mites air tubes are absent. The class is a very diverse one, the differences in structure being almost as wide as in the Crustacea.

Most of the members of this class are predaceous or parasitic on other animals and some are of very great economic importance because of the part they play in transmitting serious animal diseases.

The scorpions (Plate 41; fig. 1) are nocturnal in habit and sometimes attain a length of as much as eight inches; they are predaceous on other animals, insects and spiders forming the most important source of their food supply. A poison sting is situated at the tip of the abdomen and is frequently used in paralysing the larger insects or other small animals on which the scorpions live.

The spiders (Plate 41; fig. 2) are well known predatory enemies of insects, but as they do not discriminate between destructive and beneficial species their actual value to the farmer is somewhat difficult

to assess. Many spiders lead a sedentary existence, trapping their prey by means of snares of silk spun from the silk glands. Others obtain their prey by chase.

The mites (Plate 41; fig. 3) are generally very small animals that sometimes occur in enormous numbers. Some species attack plants, *e.g.*, the so-called red spider, others are animal parasites, while quite an appreciable number live in decaying organic matter. The ticks (Plate ; fig. 4) are well-known stock pests that are frequently responsible for the transmission of very serious diseases.

Insects.

The fifth and last class to which reference must be made is the most important of the five discussed and is known as the Hexapoda or insects.

The body segments in this class (Plate 41; fig. 5) are distinctly grouped into three sections—namely, head, thorax, and abdomen. The head almost invariably bears a pair of antennæ, while the thoracic or middle section of the body possesses three pairs of jointed legs and also bears two pairs of wings; the latter are very frequently closely folded on the abdomen when the insect is not in flight. Insects breathe by means of air tubes which radiate throughout the whole body.

Insects have shown wonderful powers of adaptation and they have succeeded eminently in the struggle for existence on land; so much so that, without being unduly pessimistic, it may be claimed that the future will witness a severe struggle between man and insect for the world's available food supply. The wonderful success of insect life on land has not, however, been repeated in either fresh water or in salt water; only a comparatively few species pass both the adult and larval stages of their life cycles in or on the former while the number of marine insects is extremely small.

More than half a million species of insects are already known to science and some of the most destructive of these are steadily spreading throughout the world. The toll levied by some species is enormous, and what would otherwise have been profitable branches of agriculture have, in certain countries, been reduced to a state of stagnation owing to insect attacks, and they offer little or no inducement for further development. Other species are notorious as carriers of very virulent diseases of man and beast, and the settlement of some very fertile areas has been greatly impeded by the prevalence of these insect-transmitted diseases.

It is only recently that mankind has realised just how much his physical and material wellbeing depend on his ability to successfully combat these small but tremendously powerful enemies. The realisation of the seriousness of the position has led to markedly increased activity in economic entomological research throughout the world, and the results achieved in some investigations encourage the hope that in many of the other as yet unsolved problems success will lie with man in his fight against the insect world.

MIXING OF CONCRETE—MATERIALS AND PROPORTION.

Concrete has many uses on the farm, and its popularity as a building material is steadily growing. In the course of a paper on this subject read recently before members of March Branch of the New South Wales Agricultural Bureau, Mr. N. Griffith submitted a paper of which the following is a digest:—

The materials, such as sand, gravel, broken stone, and cinders, which are bound together to form concrete, are termed aggregates. Fine aggregates are sand and stone screenings; coarse aggregates are gravel and broken stone, and it is a general rule to use two parts of coarse material to one part of fine. It is necessary that the sand be coarse and clean. Fine sand may require several times as much cement as coarse sand to produce concrete of the same strength. Sand containing a large proportion of fine particles will make a concrete of low strength, and be easily penetrated by water, unless a large amount of cement is used. A sand containing a small amount of clay (say, not more than 4 per cent.) may be used, but a clean sand is preferable, although sometimes a small amount of clay may strengthen a weak concrete.

To test a sand put about 4 inches of it in a glass vessel, fill with water to within an inch of the top, cover, shake for five minutes, and allow to settle. The sand will sink to the bottom, the loam will remain on top. If there is more than a quarter of inch of loam the sand should not be used without being washed. Vegetable or organic impurities in the sand are extremely injurious, even in small quantities. Stone screenings instead of sand may be used, provided they are free from dust and impurities and reasonably hard. They should pass through a quarter-inch mesh.

The Best Type of Stone.

Broken stone should be clean, hard, and of a size suitable to the character of the work in which it is used. A stone which breaks into angular shapes is much to be preferred to one that gives thin flat pieces. soft limestone, soft sandstone, slate, &c., should not be used. For thin walls or a network of reinforced concrete, the largest portion of stone should not be more than 1 inch square; for heavier work it may be increased to 2 or 2½ inches. As a rule the diameter of the largest piece of stone should not be greater than quarter to one-sixth the thickness of the concrete. A mixture of coarse and fine stone will give the best results.

Gravel can often be obtained from the banks or beds of creeks. If it is clean and well graded it is just as suitable as stone; but it should be screened over a ¼-inch screen, the parts passing through being used as sand. As a rule the gravel and sand run into pockets or seams, making some parts deficient in fine aggregate, while others have too much—thus the necessity for screening. Sandstone or gravel may be washed by placing it on a sloping platform or screen and turning a hose on it, or by throwing buckets of water on it. Cinders are sometimes used for concrete where little strength is required. They are entirely unsuitable for general concrete work. When used they should be free from dust, ashes, and unburned coal.

Correct Proportions Important.

The correct proportion of stone, sand, and cement to use is of the utmost importance. The problem in proportioning concrete is to determine the correct amounts which must be used in order to obtain the best results at the lowest expense for labour and materials. The voids or open spaces between the materials must be filled. If the broken stone is of a uniform size there will be about 50 per cent. of void, and in the case of screened gravel about 40 per cent. In sand, the voids form about 30 per cent., and in cement about 50 per cent. When these materials are mixed together with water most of the sand goes into the voids of the stone, and the cement paste remaining after the particles of sand and stone are coated goes into the voids of the sand.

The voids in broken stone or gravel may be found by filling a measure level full with the material to be tested; weigh it, and pour in water till the measure will hold no more; weigh the measure again and take the difference in the two weights, this being the weight of water required to fill the voids. Now fill the vessel with water, weigh again and divide the weight of water required to fill the voids by this weight, and the quotient multiplied by 100 will be the percentage of voids in the material tested. To find the voids in fine aggregates pour the sand into the water, otherwise there will be a considerable number of air pockets.

Percentage of Sand.

The percentage of sand to be used for concrete must be a little greater than the voids to be filled, as the sand gets between the stones and holds them apart. Experiments show that with the same percentage of cement the concrete will be strongest and most impermeable when the fine and coarse aggregates are so proportioned to

give the greatest density. If the amount of sand used is either more or less than enough to fill the stone voids with mortar, the concrete will be less dense and more cement will be required to give the same strength. It is approximately correct to use a volume of sand equal to one-half the amount of gravel or stone. If the concrete is well tamped, and more mortar flushes to the top than is required to cover all the stones, then less sand may be used, but if it is difficult to get any mortar to flush the top then more sand should be used.

A rich mixture of 1 part cement, 1½ parts sand, and 3 parts stone or gravel is generally used for columns or reinforced buildings and thin walls that must be watertight, and wherever a strong, dense concrete is required. A good mixture of 1-2-4 is generally used for reinforced concrete work of all kinds, and is best adapted for general concrete work. A medium mixture of 1-2½-5 parts is used for plain (not reinforced) concrete work of all kinds—i.e., foundations, walls, floors, and all purposes for which a good concrete is required. A lean mixture of 1-3-6 is used in heavy masses where the loads are wholly compressive, and where the principal requirements are weight and stability, as in heavy walls, foundations, and bridge piers. Leaner mixtures than these are not recommended.

PLATE 42.—THE CHAMPION BERKSHIRE SOW AT THE MELBOURNE SHOW, 1926. E. P. WORNER'S "BRENTWOOD IRENE," 6890, BRED BY G. A. BEDWELL, OF NEWMARKET, VICTORIA.

Note the typical markings, the characteristic development, and the well-built-up body of this famous brood sow.

Berkshires are the most popular breed of pig in Australia. They are reliable and productive, and have a place to fill on every farm where it is desired to show a profit. A pamphlet descriptive of the Berkshire breed is available gratis with other pig-raising literature on application to the Department of Agriculture and Stock, Brisbane.

Answers to Correspondents.

BOTANY.

In the course of the month the Government Botanist, Mr. C. T. White, F.L.S., addressed the following replies to correspondents, and which are of general interest:—

"White Cedar"—Brigalow.

R.B.H. (Lautoka, Fiji)—

The specimen seems to represent *Melia Azedarach*, a tree widely spread over the Asiatic and Eastern Australian regions. It varies a good deal according to geographical distribution and has been divided into several species and varieties. The Australian variety is well known to you as the "White Cedar." "Pride of India" and "Persian Lilac" are names given to it in garden cultivation. The botanical name of the Brigalow is *Acacia harpophylla*.

"Jacobean Lily."

R.A. (Atherton)—

The specimen proved to be *Sprekelia formosissima*, commonly known as the "Jacobean Lily." It is a native of Mexico and Guatemala and was introduced into European gardens as early as 1593. It is only occasionally seen in Queensland gardens, but bulbs are listed by most of the leading nurserymen.

Tree Poisoning.

W.S. (Murgon)—

Your inquiry regarding a poison for trees was referred to the Agricultural Chemist, Mr. J. C. Brünnich, who advises as follows:—Arsenic made in solution with caustic soda may be used for killing trees, but the boring of a hole, or holes, into the stem and filling with the poisons is only in some cases successful. Boring right into the centre would be no advantage as the poison must circulate in the growing tissue just between bark and wood. Therefore, ringbarking or ringing the tree and pouring poison in the cuts is much more successful."

A Native Legume—"Tick Trefoil."

R.C.F. (Clump Point, N.Q.)—

Specimen No. 1 is *Pycnospora hedysarioides*, a small native legume for which a common name is not known.

Specimen No. 2 is *Desmodium polycarpum*, a species of "Tick Trefoil"; so called on account of pieces of the seed-pod often adhering to clothing and other fabrics. Both of these plants, so far as we know, are quite wholesome. They would benefit the soil in the same way as other legumes. Their propagation in the pasture is advisable. We have commonly seen No. 2 growing in rather wet, swampy places.

Specimen No. 3—*Desmodium* sp.—Another species of "Tick Trefoil," but the specimen sent is scarcely sufficient for specific determination. We do not think subterranean clover would do well at Clump Point.

Sedum Praealtum.

W.B. (Brisbane)—

The species of Sedum or Stonecrop, which you brought to Mr. White for determination some time ago, and which could not be placed satisfactorily, was sent to the Royal Botanic Gardens, Kew. We have now been advised by the Kew authorities that the species is *Sedum praealtum*, a native of Mexico.

Tapeinocheilos queenslandiae.

W.T.C. (Cooktown)—

Your specimen proved to be *Tapeinocheilos queenslandiæ*, a native of the scrubs of various parts of North Queensland. It is not uncommon in the scrubs at the foot of the Bellenden-Ker Range and similar species are fairly common in New Guinea. The plant belongs to the ginger family (Zingiberaceæ), but we have not heard a local name applied to it. We were very pleased to get the specimen, and will always be glad to report on any specimens you care to send from your interesting locality.

"Native Quinine"—Whitewood—Moreton Bay Ash—*Xerotes Leucocephala*.

R. McG. (Roma)—

(1) Plant mistaken for Poison-peach or Peach-leaf Poison Bush (*Trema aspera*). This proved to be *Alstonia constricta* var. *mollis*, a native of Queensland and New South Wales, stretching from the coast to a considerable distance inland. It is known by various local names such as "Native Cinchona," "Native Quinine," "Bitter Bark," &c., all due to the very bitter nature of the bark. It suckers freely from the roots and on this account is in some places regarded as a bad pest in cultivation.

(2) Whitewood, *Atalaya hemiglauca*.—A very common tree throughout Western Queensland, also found in New South Wales.

(3) Carbeen, leaves only, but I should say *Eucalyptus tessellaris*. On the coast this tree is almost universally known as Moreton Bay Ash. Inland and in New South Wales it goes under the name of "Carbeen."

(4) Grass-like plant with the base covered with a cottony substance, *Xerotes leucocephala*, rather an anomalous member of the Liliaceæ or Lily family.

***Lantana Sellowiana*.**

J.L. (Brisbane)—

Your specimen is a small species of Lantana (*Lantana Sellowiana*), a native of South America, commonly cultivated in Queensland gardens as an ornamental plant, climbing over rockeries, fences, &c., and has here and there run out, and become to some extent a pest. Other Lantanas, including the common one, cause a trouble in cattle known as "pink-nose." We have no definite information regarding the species you send, but have no doubt its properties are similar to the common species, and if eaten in quantity would cause trouble.

Onion Couch.

A.N.W. (Maleny)—

It is almost impossible to name grasses in the absence of seed-heads, but the one you send apparently represents the "Onion Couch" (*Arrhenatherum avenaceum* var. bulbosum), a very bad weed on European farms. It has been previously recorded for the Southern States, but so far as known has not previously been met with in Queensland. Eradication is extremely difficult owing to each little "knot" or "bulb" forming a new plant when cut free by cultivation implements. If only in a small patch, hand forking and careful burning are the most satisfactory methods of eradication, and this would have to be done periodically as fresh pieces grow. If you could send a fresh specimen we would feel much indebted. Probably our summers will prove too hot for the grass to set good seed. Have you noticed seed-heads on it? We would be especially glad of one if you have.

"Blue Top."

F.H.T. (Townsville, N.Q.).—

There are three or four plants or more in North Queensland that go under the local name of "Blue Top." One of the most common is *Ageratum conyzoides*, but to make sure send a small specimen.

"Native Lucerne" or "Herb-Vine."

T.W. (Longreach)—

The specimen proved to be *Psoralea cinerea*, a plant commonly known in Australia as Native Lucerne, a name, however, also applied to other species of the genus, of which we have about a dozen in Queensland. The particular one you send is not uncommon in Western Queensland and the Northern Territory, and is also found in Western New South Wales. On Brunette Downs it is known as "Ervine" or "Herb-vine," and is looked upon as one of the best fattening fodders in the country. Most of the genus here and also abroad are regarded as good fodders. For travelling sheep or other stock they would of course bloat, particularly on an empty stomach, but any succulent feed such as pig weed, lucerne, and other herbage would act in the same way. On the other hand, the plant you send has been suspected of poisoning cattle on the Flinders River, but in view of the generally good reputation of the plant, it is not likely that it is poisonous to stock.

"Sassafras"—(Cinnamomum Laubatii).

"Inquirer" (Brisbane)—

Most of the leaves belong to *Cinnamomum Laubatii*. This species was named by Ferd. von Mueller but was synosagmised by Bentham with an Indian species—*C. Tamala* Mees. Recent researches would tend to show, however, that the Indian and Australian trees are distinct, and that Mueller was right in giving it a specific name. The tree is known in North Queensland as "Sassafras."

Gidyea Poisoning of Stock.

T.M.T. (Brisbane)—

Gidyea poisoning reports are rather conflicting. In the annual report of the Department of Agriculture and Stock, Brisbane, for 1918, the Chief Inspector of Stock (Major A. H. Cory, M.R.C.V.S.) printed a letter from Mr. G. R. Beauchamp, of Westward Ho, Boulia, dated 25th November, 1918:—"I had a good chance here the other day of proving beyond doubt that the gidyea, while in pod, will poison cattle. Being short of grass near the homestead, I broke down some gidyea limbs for the goats. Just then the milking cows were let out of the yard, and two of them ate some of the gidyea I had broken down for the goats. These two cows were poisoned. When I found this out, I had a look at the gidyea and noticed that the limbs were heavily laden with pods. It is this bean that, in my opinion, causes all the trouble."

This letter would seem fairly conclusive, but we also hear reports of cattle eating gidyea without any ill effects following. There are two kinds of gidyea in Queensland, and both are species of wattles, belonging to the genus Acacia. In regard to wattles on the coast as feed in times of drought conflicting reports are heard, the majority of stockowners looking upon them as a good forage and a standby in times of drought, others reporting losses of stock through them. My own belief is that the trouble mostly occurs when the wattles are full of green unripe pods. The pods or beans of many wattles contain a saponin, a glucoside, some forms of which are known to be poisonous. At other times the gidyea and other wattles, I believe, may be eaten with impunity. It is a question, however, on which we have little definite information, and, in my opinion, is one worthy of research by means of feeding experiments and chemical analysis. A specimen of Whitewood was handed over to me at the same time. It is *Atalaya hemiglauca*, known universally throughout Western Queensland as "Whitewood." It is a good fodder, but the young shoots are said to give horses the staggers. This, however, is a question on which we have no very definite information.

Trees in Pear Country.

W.S. (Westbrook)—

Regarding timber locked up in pear, none is, so far as I can call to mind, of any special value. The three commonest are, of course, the ordinary Box or Bimbil Box (*Eucalyptus populifolia*), the Brigalow (*Acacia harpophylla*), and the Beelah (*Casuarina lepidophloia*). The first is one of the poorest of the Eucalypts and rarely found sound in large sizes, therefore only used for fence posts, &c. I have seen beautiful furniture from Brigalow, but very heavy. The Beelah is only used for rough bush work and it decays in contact with the ground. It could be used for cabinet work, and Mr. R. T. Baker, late Curator of the Technological Museum, says that it is the most suitable of all Australian timbers for shaft bearings, being the nearest substitute for Lignum-vitæ so extensively used for this purpose. The Bastard Sandalwood (*Eremophila Mitchellii*) is used to a limited extent for small fancy articles.

"Cape Cotton" or "Wild Cotton."

N.G. (Mullett Creek)—

The weed with balloon-like pods is the Cape Cotton or Wild Cotton (*Gomphocarpus fruticosus*). We would advise you if possible to get rid of this before it sets seeds, as it can become a very bad pest. It has been suspected of poisoning stock in Queensland, though nothing definite has been proved against it. It belongs, however, to a dangerous family—the Asclepiadaceæ. The seeds when ripe have a fine tuft of silk-cotton on the ends; this, however, has no value for spinning but only as a kapok, and its collection for this purpose would not pay. The stems contain a strong fibre.

Tree Propagation.

T.B. (Warwick)—

Cupressus torulosus and other species are best struck from the young tips a few inches long, placed, if possible, in rather sandy soil and kept moist, and protected from the hot sun. Cupressus can be more easily raised from seed, but some of the horticultural forms do not come true to type.

Planes can be struck from the last year's wood when the leaves have fallen. Pieces eight to ten inches long with a heel of old wood at the base are best.

Poplars strike more easily than Planes; pieces of the leafless branchlets, 8 to 12 inches long, placed about half in the soil strike readily.

Prune and Myrobalan Plums.—We do not know any special treatment. Sown fresh from the fruits they should germinate freely enough.

Plants Identified.

W.R. (Kawl Kawl)—

The specimens are very small but seem to represent the following plants:—

1. *Chenopodium murale.* "Goosefoot." A common weed on the Downs and similar localities. Not harmful in any way, but does not seem to be eaten much by stock. Sometimes called "Fat Hen," a vernacular applied to several weeds in Queensland.

2. *Tetragonia expansa.* New Zealand Spinach. Sometimes used as a substitute for ordinary spinach.

3. *Malvastrum tricuspidatum.* A common weed sometimes mistaken for the common *Sida retusa.* It is not harmful in any way but is rather aggressive. We have not heard a common name applied to it.

4. *Ipomœa plebeia.* "Bell Vine." Becomes a pest by climbing up the stalks of cane and other crops.

5. *Helipterum polyphyllum.* A native plant for which we have not heard a local name. It is not harmful in any way and is not an aggressive weed.

6. *Chenopodium sp.*, probably *Chenopodium album.* A "Goosefoot" or "Fat Hen." Remarks similar to No. 1 apply.

PIG RAISING.

Following are selected replies to correspondents by the Instructor in Pig Raising, Mr. E. J. Shelton, in the course of the month, and which are of general interest:—

Excessive Salt in Pig Food.

Case: An inquirer asked for advice concerning the sudden death of five pigs which had been given water in which mangel wurzels had been boiled as part of their food. The pigs were severely distressed and suffered great pain and their owner was puzzled as to the cause of the trouble. The pigs had on a previous occasion (no record of when) been given similar liquid without any apparent ill-effect.

Reply: A sample of the water was analysed by the Agricultural Chemist who found no common poison in the liquid, which, however, contained about 175 grains of salt to the gallon. It is apparent that the high percentage of salt in the water was partly the cause of the trouble. The mangel wurzels being somewhat tough and fibrous in the green state before being cooked, and lacking nutriment, would probably be a contributory cause. Constipation and disorders of bowels are responsible for many apparently sudden deaths in pigs, and on many occasions death has been suggested as being due to poisoning, &c., when in reality it is due to stoppage of the bowels, the result of the continued use of dry fibrous foods. Quite recently we investigated the cause of death of a brood sow that had shown signs of severe pain, and swelling up to an abnormal size both prior to and immediately after death. The stomach on examination was practically full of dry fibrous shreds of wattle bark and similar fibrous matter which the sow had evidently eaten in an endeavour to satisfy her craving for some "green" or protein (flesh forming) food.

We investigated a case recently also in the Central Burnett district in which a number of pigs fed on buttermilk had suddenly died, the analysis of this buttermilk showed that it contained an excess of salt which, acting as an irritant to the stomach and bowels, led to fatal results.

Under ordinary conditions salt may be placed before pigs as a condiment—it really is a necessity in all foods—or as a food and they would not partake of it to excess, but where pigs have suffered from a deficiency of salt and mineral matters in their food they are inclined to eat too freely, this especially so where the salt is mixed in with the food or fluids given to the pigs. Cases are not uncommon in which pigs have died as a result of brine poisoning, this especially so where corned beef water or the water in which a ham has been cooked is mixed with the milk or kitchen waste. Soap powders, soda water and the like cause similar trouble.

It takes but a few minutes after eating or drinking an excess of salt for symptoms of poisoning to develop. However, in the case under review it would appear that unless salt was accidentally added to the water in which the mangels were cooked the trouble was caused by excess of fibrous matter and lack of nutriment together with constipation or some other disorder of the bowels.

Mortality Among Pigs.

F. J. P. (Dallarnil)—

It is noted that the pigs were fed on a mixture consisting of boiled bottle-tree (chaffed), molasses, milk, and pollard. We presume, on account of the very severe spell of dry weather recently experienced and the high prices of concentrated foods, that there has been a shortage of milk and pollard, and that the bulk of the food consisted of boiled bottle-tree (chaffed) and molasses. There is little or no nutriment in either of these foods, the bottle-tree portion consisting practically entirely of water and fibre, and the molasses containing no protein or flesh-forming elements, it being at best a heat and energy producer and a condiment but of little actual food value.

Without actual analysis and postmortem examination it is of course somewhat difficult to definitely diagnose the cause of death, but on the surface it would appear that digestive disorders and stoppage of the bowels with possible extensive inflammation of the bowels has been the cause.

Pigs require liberal supplies of green food, clean drinking water, and mineral matters in addition to their ordinary food, milk, grain, &c., in order to be able to develop properly and to reproduce themselves to advantage. An excess of sugar, as in cases where too much molasses has been added to the food, is just as likely to result in disaster as where an excess of salt is present, and perhaps in this case some of the stronger pigs fighting their way to the front of the trough received all the milk leaving the balance of the pigs to consume all the dry fibrous food and to have practically no moisture or drinking water at all.

Diseases in Pigs.

C.E.L. (Bajool)—

Disease is often due to disorders of the digestive system, to severe indigestion, and to inflammation of the stomach and bowels. It is often induced by neglected breeding, by weaning too early, and by lack of mineral matters in the food. Pneumonia and affections of the lungs are also a prolific cause of complaints affecting the nervous system and of interference with the normal development of the animal. Pamphlets on the "Administration of Medicine to Pigs" and "Profitably Feeding Iodine to Pigs" forwarded.

Foods for Young Pigs.

K.O.H. (Westbrook)—

Just as to what feeds are the most efficient and economical for young pigs in the absence of milk and green stuff, and during periods of excessively high prices for all classes of concentrated food, is a difficult question to answer. You should be able to gain a good deal of information locally by visiting the Farm Homes for Boys, Westbrook, and discussing this matter with Mr. Jones, the Superintendent. If there is no skim milk or other dairy product and no green stuff, then there is nothing for it but water and concentrated foods, with the addition possibly of a small proportion of

molasses as a condiment and an aid to digestion, and, perhaps, in extreme cases, the use of prickly-pear boiled after the prickles have been removed by singeing.

Of concentrated foods the commonest form in use in wheat-growing districts is pollard or wheatmeal with grain sorghum meal (Milo and Feterita seed ground to a meal form), and in some cases Barley Meal. Pollard is, however, scarce and high-priced. It, however, is a very useful food, and many farmers have found that it can be used to advantage where prickly-pear is boiled, cooled down, and fed as a mash; in some instances meat foods are used, as in cases where cattle or horses and calves are slaughtered and boiled down for use as pig food.

Barley meal, rice meal, pea meal, and grain sorghum meal are all useful, but they, too, are high-priced and in short supply. All clases of root crops, English potatoes (of which a proportion usually find their way to the pig bucket), sweet potatoes, artichokes, swede turnips, cassava, arrowroot, &c., are also in short supply, while pumpkins and the like have been so high-priced that they have been absolutely prohibitive as pig foods.

There are certainly no cheap pig foods of sufficiently good quality readily available at the present time, but if you wrote to the Wheat Board they would be able to advise as to whether they had any wheat available suitable for pig-feeding or any grain sorghum meal. Produce merchants would willingly quote for any grain or meals available.

PLATE 43.—THREE CHARACTERISTICS OF THE MODERN BERKSHIRE—CONTENTMENT, CONSTITUTIONAL VIGOUR, AND COURAGE.

This well known winner, "Britannia Brigadier," and his owner, Mr. Charles Dawson, of Belmore street, Dundas, N.S.W., takes a pride in facing the photographer. Charlie is satisfied he has a remarkably good pig, while Brigadier is content to wear his ribbons and pose.

Three characteristics of the successful pig raiser—(1) knowledge of the job; (2) love of the animals; and (3) judicious handling both of the food supplies and of the breeding stock and progeny. Britannia Brigadier is a well known prize-winner at Sydney Show. His stock also have won many prizes.

Plate 44—The Champion Tamworth Sow at the Melbourne Show, 1926. E. V. Harley's "Hawkesbury Rosie," 504, bred at the Hawkesbury Agricultural College, Richmond, N.S.W.

The Tamworth breed stands in the forefront for purposes of crossbreeding for the production of early maturing fleshy bacon pigs. Note this sow's wonderful body development, her compact, thick-set frame, and the capacity for development as she grows older. The fine quality skin and hair, and the development of teats and udder are worthy of note. A pamphlet descriptive of the Tamworth breed is now available, with other pig-raising pamphlets, on application to the Department of Agriculture and Stock, Brisbane.

GREEN PEAS—HARVESTING AND MARKETING POINTS.

Pods should be picked as soon as the pea kernels are full and give the pod a tight feel, but before any loss of colour occurs, such as is the case when on the turn to maturity. Twenty-eight pounds of green peas is the usual trade recognition of a bushel weight. Growers sending their peas long distances must always allow for loss by shrinkage in transit, and in some cases it is usual to reckon on a 2 lb. loss per bushel.

If the peas have to be stored on the farm overnight or for any time before despatch it is advisable that they be spread out on the floor of a shed rather than left in bags. Sweating in heaps in the shed will not be harmful to the same extent as would be the case in bags, particularly when done up in full chaff bags. The usual method of marketing is in small bags—about 2 bushels in size—which are made by the grower or supplied by the agent who is to dispose of them.

For local markets it is often an advantage to do up in small lots of 7 lb., more or less, in order to cater for family supplies.

Picking costs vary with the crop. The usual price is somewhere about 1s. 6d. per bushel, but with high yields it may be possible to secure pickers at a lower price. When the yield is low the price increases proportionately, and under these conditions it is only possible for the grower to bear such an expense when market prices are high.

A careful watch should be kept on the pickers to see that only the full pods are harvested. Immature and discoloured pods should be eliminated from any consignments marketed.

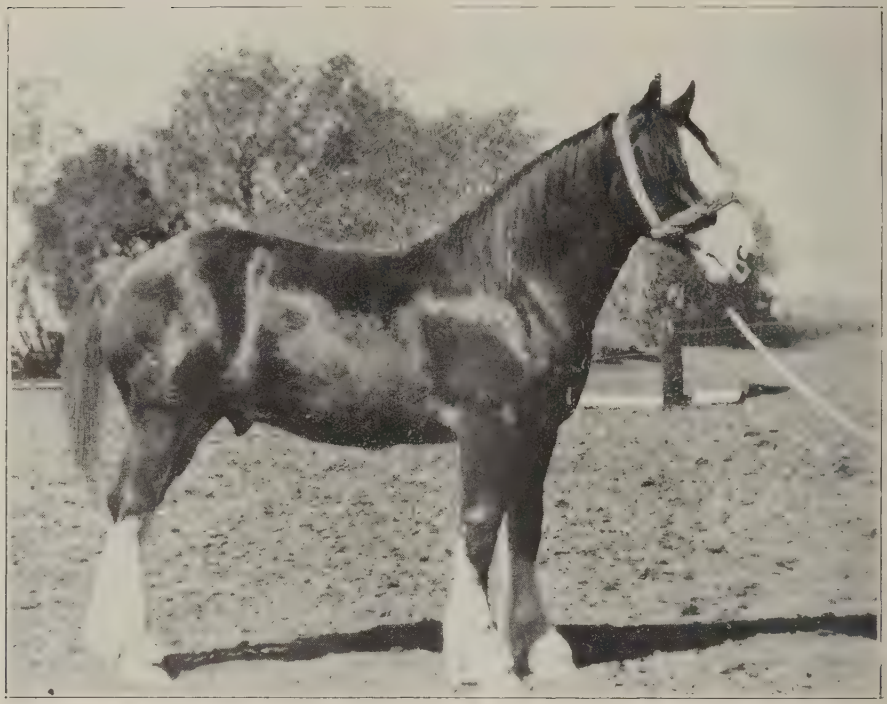
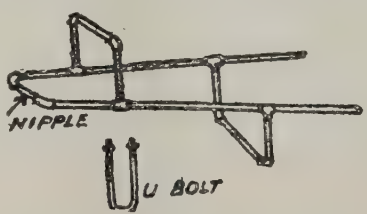


PLATE 45.—"FABRIC'S PRIDE," AGE 10 MONTHS.

"Fabric's Pride."—A well-developed foal by "Fabric's Heir," one of the State Stallions, from a Stud Book mare, at 10 months—the property of Mr. E. L. Reinke, of Murra Murra, Crow's Nest.

WHEELBARROW FRAME.

A substantial gear for a wheelbarrow can be made of 1-inch pipe and fittings as shown in the illustration from "Country Gentleman." The extreme length of the frame is 4 feet 6 inches. The two sides are joined at the front by means of two elbows and a nipple, the nipple answering for a shaft upon which the wheel can turn. If, instead of an open wheel, one with a spindle on each side is used, the nipple can be left out and suitable wooden boxings bored and driven into the elbows. The front standards of the barrow as well as the legs are joined together by means of elbows



and a piece of pipe. These two connecting pipes should be threaded for 2 inches or more on one end in order that they may be screwed in as far as they will go, since they will necessarily be unscrewed a little when the other end is being screwed into the elbow. The box, which is of wood, should be attached to the frame by means of flat clips or U bolts that encircle the pipe and are screwed to the wood.

When the box is in place there will be no tendency for the frame to give or spring apart at any point. Such a barrow will last for a generation. It is simple in construction and neat in appearance. When the boxings or shaft wear they can be quickly removed and new ones put in.

Farm Notes for March.

Land on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the next few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where blight has previously existed, or where there is the slightest possible chance of its appearing, preventive methods should be adopted—*i.e.*, spraying with "Burgundy mixture"—when the plants are a few inches high and have formed the leaves; to be followed by a second, and, if necessary, a third spraying before the flowering stage is reached.

Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for twenty-four hours and subsequently aerated and stored in airtight containers. Weevils are usually very prevalent in the field at this time of the year and do considerable damage to the grain when in the husk.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Packed cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags or hessian sheets, before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *phalaris bulbosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which were too far advanced to benefit by the recent rains, and which show no promise of returning satisfactory yields of grain, would be well advised to convert these into ensilage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Soudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into ensilage, it will be found that this method of conserving them has much to recommend it. Stacking with a framework of poles, and well weighting the fodder, is necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full eave and held in position by means of weighted wires.

Orchard Notes for March.

THE COASTAL DISTRICTS.

As soon as the weather is favourable, all orchards, plantations, and vineyards that have been allowed to get somewhat out of hand during the rainy season should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necessary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out, as there is no greater cause of injury to a banana plantation than neglect to cultivate. Good strong suckers will give good bunches of good fruit, whereas a lot of weedy overcrowded suckers will only give small bunches of undersized fruit that is hard to dispose of, even at a low price.

The cooler weather will tend to improve the carrying qualities of the fruit, but care must still be taken to see that it is not allowed to become over-developed before it is packed, otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Only one size of fruit of even quality must be packed. Smaller or inferior fruit must never be packed with good large fruit, but must always be packed separately as required by regulation.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and as soon as the fruit is disposed of plantations which are apt to become somewhat dirty during the gathering of the crop must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possession and soon kills the crop. In addition to destroying all weed growth, the land should be well worked and brought into a state of thorough tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green. Citrus fruits of all kinds require the most careful handling, as a bruised fruit is a spoilt fruit, and is very liable to speck or rot. The fungus that causes specking cannot injure any fruit unless the skin is first injured. Fruit with perfect skin will eventually shrivel, but will not speck. Specking or blue mould can therefore be guarded against by the exercise of great care in handling and packing. At the same time, some fruit is always liable to become injured, either by mechanical means, such as thorn pricks, wind action, hail, punctures by sucking insects, fruit flies, the spotted peach moth, or gnawing insects injuring the skin. Any one of these injuries makes it easy for the spores of the fungus to enter the fruit and germinate. All such fruit must therefore be gathered and destroyed, and so minimise the risk of infection. When specked fruit is allowed to lie about in the orchard or to hang on the trees, or when it is left in the packing sheds, it is a constant source of danger, as millions of spores are produced by it. These spores are carried by the wind in every direction, and are ready to establish themselves whenever they come in contact with any fruit into which they can penetrate. Specking is accountable for a large percentage of loss frequently experienced in sending citrus fruits to the Southern States, especially early in the season, and as it can be largely prevented by the exercise of necessary care and attention, growers are urged not to neglect these important measures.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The flat bushel-case (long packer) commonly used for citrus fruits, does not lend itself to up-to-date methods of grading and packing, and we have yet to find a better case than the American orange case recommended by the writer when he came to this country from California in 1892, and which has again proved its superiority in the recent shipments of oranges from the Southern States to England. Failing this case, a bushel-case suggested by the New South Wales Department of Agriculture is, in the writer's opinion, the most suitable for citrus fruits, and were it adopted it would be a simple matter to standardise the grades of our citrus fruit, as has been done in respect to apples packed in the standard bushel-case used generally for apples throughout the Commonwealth. The inside measurements of the case suggested are 18 in. long, 11¾ in. wide, and 10½ in. deep. This case has a capacity of 2,200 cubic inches, but is not included in the schedule of the regulations under "*The Fruit Cases Acts*, 1912-1922." The half-bushel case, No. 6 of the Schedule above referred to, is 10 in. by 11¾ in. by 5¼ in. inside measurements with a capacity of 1,100 cubic inches. The case should be suitable for oranges and the half-case for mandarins. No matter which case is used, the fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to speck to be removed prior to despatch.

Fruit fly must be systematically fought in all orchards, for if this important work is neglected there is always a very great risk of this pest causing serious loss to citrus growers.

The spotted peach-moth frequently causes serious loss, especially in the case of navels. It can be treated in a similar manner to the codlin moth of pip fruit, by spraying with arsenate of lead, but an even better remedy is not to grow any corn or other crop that harbours this pest in or near the orchard. Large sucking-moths also damage the ripening fruit. They are easily attracted by very ripe bananas or by a water-melon cut in pieces, and can be caught or destroyed by a flare or torch when feeding on these trap fruits. If this method of destruction is followed up for a few nights, the moth will soon be thinned out.

Strawberry planting can be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

The advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be carefully followed. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable the growers in that district to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes, and it is pleasing to note that some growers are packing their fruit very well. Those who are not so expert cannot do better than follow the methods of the most successful packers.

Parrots are frequently very troublesome in the orchards at this time of the year, especially if there is a shortage of their natural food. So far, there is no very satisfactory method of combating them, as they are very difficult to scare, and, though shooting reduces their numbers considerably, they are so numerous that it is only a subsidiary means.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of requiring water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening state, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much water is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light irrigation is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

SHOW DATES FOR 1927.

Stanthorpe: 2nd to 4th February.
Warwick: 8th to 11th February.
Allora: 16th and 17th February.
Clifton: 24th and 25th February.
Goombungee: 3rd March.
Killarney: 9th March.
Milmerran-Pittsworth, 22nd March.
Inglewood: 22nd and 23rd March.
Toowoomba: 28th to 31st March.
Dalby: 7th and 8th April.
Chinchilla: 12th and 13th April.
Sydney Royal: 11th to 20th April.
Herberton: 18th and 19th April.
Nanango: 21st and 22nd April.
Beaudesert: 27th and 28th April.
Oakey: 29th April.
Kingaroy: 28th and 29th April.
Taroom: 2nd to 4th May.
Charleville: 4th and 5th May.
Wondai: 5th and 6th May.
Toogoolawah: 6th and 7th May.
Mitchell: 11th and 12th May.
Murgon: 12th and 13th May.
Blackall: 10th to 12th May.
Roma: 17th and 18th May.
Ipswich: 18th to 20th May.
Kilkivan: 18th and 19th May.
Wallumbilla: 24th to 26th May.
Maryborough: 24th to 26th May.
Childers: 28th to 31st May.
Marburg: 2nd and 3rd June.
Gin Gin: 2nd to 4th June.
Bundaberg: 8th to 10th June.
Wowan: 8th and 9th June.
Maleny: 23rd and 24th June.
Kilcoy: 29th and 30th June.
Esk: 15th and 16th July.
Ithaca: 23rd July.
Laidley: 27th and 28th July.
Royal National: 8th to 13th August.
Crow's Nest: 24th and 25th August.
Imbil: 7th and 8th September.
Beenleigh: 15th and 16th September.
Stephens: 17th September.
Nundah: 30th September and 1st Oct.
Kenilworth: 6th October.

This list may be added to.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING NOVEMBER, 1926 AND 1925, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov., 1926.	Nov., 1925.		Nov.,	No. of Years' Records.	Nov., 1926.	Nov., 1925.
North Coast.					*South Coast*—continued:				
	In.		In.	In.		In.		In.	In.
Atherton	2·97	25	0·68	0·60	Nambour	3·90	30	0·22	5·52
Cairns	3·99	44	1·86	2·16	Nanango	2·65	44	0·71	4·73
Cardwell	4·01	52	1·27	3·18	Rockhampton ...	2·20	39	0·03	1·50
Cooktown	2·68	50	0·53	1·39	Woodford ...	3·24	39	0·45	6·94
Herberton	2·47	39	2·17	1·61					
Ingham	3·50	34	3·08	0·43					
Innisfail	6·12	45	3·09	2·02	*Darling Downs.*				
Mossman	3·61	13	2·21	2·90					
Townsville	1·84	55	0·60	0·82	Dalby	2·66	56	0·77	3·85
					Emu Vale ...	2·73	30	0·76	5·17
					Jimbour	2·33	38	0·44	3·01
Central Coast.					Miles	2·41	41	0·51	2·17
					Stanthorpe ...	2·76	53	0	4·25
Ayr	1·70	39	0·15	0·27	Toowoomba ...	3·27	54	2·15	4·38
Bowen	1·30	55	0·10	0·39	Warwick	2·59	61	1·14	5·51
Charters Towers ...	1·47	44	0·23	0					
Mackay	2·89	55	1·09	0·86					
Proserpine	2·85	23	0·81	1·35					
St. Lawrence ...	2·27	55	0	1·75	*Maranoa.*				
					Roma	2·10	52	0·04	3·78
South Coast.									
Biggenden	2·68	27	1·48	2·66					
Bundaberg	2·52	43	0·13	1·29	*State Farms, &c.*				
Brisbane	3·73	75	1·73	8·53					
Childers	2·73	31	0	1·39	Bungeworgorai ...	2·27	12	0·02	2·57
Crohamhurst ...	4·39	30	0·25	7·47	Gatton College ...	2·75	27	2·13	5·94
Esk	3·19	39	1·29	5·45	Gindie	2·11	27	0·06	2·15
Gayndah	2·80	55	0·75	2·75	Hermitage ...	2·76	20	1·07	5·08
Gympie	3·18	56	0·29	5·46	Kairi	2·02	12	1·25	0·56
Caboolture	3·32	39	0·60	8·59	Sugar Experiment Station, Mackay	2·56	29	1·13	0·53
Kilkivan	2·57	47	0·67	2·41					
Maryborough ...	3·14	54	0·12	6·41	Warren	3·31	12	0	5·30

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for November, 1926, and for the same period of 1925, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
Divisional Meteorologist.

FALLOWS DEFINED.

At a recent conference of Agricultural Instructors of the Department of Agriculture of New South Wales, it was recommended that fallows of different periods should be defined as follows:—

Long Summer Fallow.—Land fallowed for at least twelve months, the initial ploughing or cultivation to be not later than May in the year previous to sowing.

Winter or Ordinary Fallow.—Land fallowed for at least six months, the initial ploughing or cultivation to be not later than October in the year previous to sowing.

Short Summer Fallow.—Land fallowed for at least two months, the initial ploughing or cultivation to be not later than February in the year of sowing.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of December, in the Agricultural Districts, together with Total Rainfalls during December, 1926 and 1925, for Comparison.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of Years' Records.	Dec., 1926.	Dec., 1925.		Dec.	No. of Years' Records.	Dec., 1926.	Dec., 1925.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	7·69	25	9·98	7·55	Nambour	6·20	30	23·99	4·56
Cairns	8·95	44	6·97	1·71	Nanango	3·76	44	7·13	3·21
Cardwell	8·45	52	8·73	1·35	Rockhampton ...	4·64	39	7·74	3·90
Cooktown	6·97	50	5·11	0·60	Woodford	5·36	39	16·68	4·01
Herberton	5·59	39	10·30	5·54					
Ingham	7·01	34	6·08	1·99					
Innisfail	11·89	45	8·21	1·49	*Darling Downs.*				
Mossman	12·55	13	7·02	5·96					
Townsville	5·52	55	7·42	5·03	Dalby	3·19	56	5·58	4·57
					Emu Vale... ...	3·53	30	3·91	1·64
Central Coast.					Jimbour	3·14	38	4·65	3·21
					Miles	2·83	41	6·60	4·86
Ayr	3·85	39	3·52	1·22	Stanthorpe ...	3·48	53	6·57	2·38
Bowen	4·39	55	6·44	2·13	Toowoomba ...	4·26	54	7·24	3·51
Charters Towers ...	3·53	44	3·77	0·87	Warwick	3·46	61	3·60	1·40
Mackay	6·83	55	7·74	8·33					
Proserpine	8·26	23	5·89	2·02	*Maranoa.*				
St. Lawrence ...	4·50	55	6·43	2·21					
					Roma	2·44	52	5·45	3·08
South Coast.									
					State Farms, &c.				
Biggenden	4·50	27	13·61	5·51					
Bundaberg	4·73	43	16·96	6·45	Bungeworgorai ...	2·74	12	6·49	2·11
Brisbane	4·96	75	9·48	6·17	Gatton College ...	3·38	27	7·25	2·97
Childers	5·53	31	16·34	7·02	Gindie	2·88	27	3·01	5·78
Crohamhurst ...	7·40	35	26·19	5·48	Hermitage ...	2·98	20	3·73	1·41
Esk	4·39	39	8·75	4·19	Kairi	6·71	12	12·97	5·19
Gayndah	4·04	55	9·64	4·43	Sugar Experiment				
Gympie	5·78	56	23·01	10·39	Station, Mackay	8·04	29	7·04	12·77
Caboolture	5·05	39	12·19	5·98	Warren	3·49	12	5·68	3·52
Kilkivan	4·43	47	12·37	6·95					
Maryborough ...	4·78	54	21·71	6·43					

Note.—The averages have been compiled from official data during the periods indicated; but the totals for December, 1926, and for the same period of 1925, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND, Divisional Meteorologist.

ILLEGAL BIRD TRAPPING.

It has come under the notice of the Department of Agriculture and Stock that a certain amount of illegal trapping of parrots and other birds was going on in the outskirts of Brisbane. The offenders in the majority of cases are boys, and it was for this reason that so far the department had refrained from instituting proceedings against them. It now desires, however, to draw attention to the fact that the present is the close season for all finches and for such parrots as kings, redwings, budgerigahs, quarrions, "blueys," and "greenies," and all persons are warned against either trapping or dealing in these birds. The open season for the abovementioned parrots does not commence until the 1st April next and the season for finches until the 1st July next.

General Notes.

Acknowledgments—Appreciation of the "Journal."

We desire to acknowledge many New Year greetings from our readers and appreciative references to the "Journal" from numerous farmers in correspondence with the Department. One farmer writes, and his remarks are typical of many:—"I enclose herewith postal note for one shilling, being the nominal fee for twelve months for the excellent periodical—the "Queensland Agricultural Journal"—the matter, paper, printing, and illustrations of which reflect credit on all concerned in its make-up."

Staff Changes and Appointments.

The Officers in Charge of Police at the following towns have been appointed Acting Inspectors of Stock as from the 1st January, 1927:—Clermont, Blair Athol, Capella, Finch Hatton, Mackay, Rolleston, Westwood, Maryborough, Bundaberg, Gayndah, Howard, Imbil, Pialba, Rosedale, Millaa Millaa, Collinsville, Jackson, Thallon, Mount Garnet, and Yaraka. Mr. F. J. Webber, of Burketown, has been appointed Government Representative on the Burke Dingo Board, Mr. H. C. S. Griffin, of Clermont, has been appointed Government Representative on the Clermont Dingo Board, and the Inspectors of Stock at Clermont and Winton have been appointed Government Representatives on the Belyando and Gregory Dingo Boards, respectively.

Messrs. H. E. Jenyns, J. B. Stephens, E. R. Geissmann, and W. Wilson, of Tambourine Mountain, Mr. L. Cain, of the Department of Agriculture and Stock, and Messrs. P. H. McLean and A. Pitts, of the Mackay district, have been appointed officers under and for the purposes of the Animals and Birds Acts.

Messrs. R. T. Croker (Malanda), F. H. Hyde (Peeramon), R. Campbell (Peeramon), D. Johnston (Malanda), A. Beattie (East Barron), and L. R. Macgregor (Director of Marketing) have been appointed Members of the Northern Pig Board as from 1st January, 1927, to the 31st December, 1927.

Messrs. R. B. Corbett (Woombye), M. H. Campbell (Albany Creek), S. Luxford (Wynnum), H. H. Stevens (Lanefield), J. Hutton (Kingsthorpe), and L. R. Macgregor (Director of Marketing) have been appointed Members of the Egg Board as from the 1st January, 1927, to the 31st December, 1927.

Mr. W. H. Thrupp, of Lauriston, Roma, has been appointed Government Representative on the Bungil Dingo Board.

"Organisation and Marketing Act of 1926"—Additional Regulations.

Regulation 37, as appearing in the "Government Gazette" of the 16th December, 1926, has been amended to provide that the maximum fees, allowances, and travelling expenses payable to Members of the Council of Agriculture shall be £2 2s. per sitting day, £1 11s. 6d. per travelling day, first class rail fares, sleepers and coach fares, or, in lieu of coach fares, sixpence per mile each way from their residence to their nearest railway station.

A further regulation has been approved providing for the filling of vacancies on any Commodity Board or the Council of Agriculture, caused by the death, retirement, or resignation of any member thereof. In the case of a vacancy on a board, the Minister may either appoint someone to fill the vacancy or order an election, the member so appointed or elected to hold office only until the next general election for members of the board. In the case of a vacancy arising, caused by the death, retirement, or resignation of a Commodity Board's representative on the Council, the board concerned shall elect one of its elected members to fill the vacancy, and the member so elected shall hold office only for the balance of the period of the tenure of office of the commodity board electing him.

Hambledon Sugar Levy.

Regulations have been approved empowering the Hambledon Mill Suppliers' Committee to make a levy on all sugar-cane growers whose lands are assigned to the Hambledon Mill at the rate of one-eighth of a penny per ton of all cane delivered from those lands to the Hambledon Mill during the period commencing 1st May, 1926, to the 28th February, 1927. Provision is made for a poll to be taken on the question of the levy, if such poll is petitioned for by at least eighty cane-growers in the abovenamed locality. The amount of the levy, if made, will be deducted by the manager of the Hambledon Mill from final cane payments due to the growers concerned, and shall be paid by the manager to the Hambledon Sugar Mill Suppliers' Committee for the purpose of administering the business of such committee.

Organisation and Marketing Act—Regulations.

Regulations have been approved under the abovementioned Act, providing as follows:—By Regulations dated the 21st January, 1926, a levy was imposed by the Council of Agriculture on canegrowers in the Homebush area, and as all the proceeds of this levy have not been disposed of, it has been approved that the balance shall be distributed by a Liquidator (Mr. F. J. Stevens, of Mackay, has been appointed Liquidator) amongst the primary producers on whom the levy was first imposed, in proportion to the amounts collected from them.

Sugar Mill Suppliers' Committees.

Regulations have also been passed providing for the election of members of the Mill Suppliers' Committees and District Cane Growers' Executives connected with the Queensland Cane Growers' Council. Forms are prescribed for the ballot-papers, nomination forms, returning officer's returns and declarations. It is provided also that at the election held in March, 1927, each Mill Suppliers' Committee, District Executive, and the Queensland Cane Growers' Council shall be elected for a period of three years for the period to the 31st March, 1930. Colonel Hooper, care of the Council of Agriculture, Brisbane, has been appointed Returning Officer in connection with these elections, and nominations must reach him not later than 6 p.m. on Monday, the 14th February, 1927.

If you like the "Journal," kindly bring it under the notice of your neighbours who are not already subscribers. To farmers it is free and the annual charge of one shilling is merely to cover postage for the twelve months.

Egg Board Election.

Following is the result of the Egg Board election, conducted by the Department of Agriculture and Stock, for two growers' representatives for Districts Nos. 1 and 2 which took place at that office on the 31st December:—

District No. 1 (Caboolture to Bundaberg).	
Ronald Benjamin Corbett (Woombye)	60 votes
Alfred Moody (Palmwoods)	39 votes
Informal	1 vote
Total	100 votes
District No. 2 (Brisbane North and Redcliffe).	
Matthew Hale Campbell (Albany Creek)	49 votes
Robert Auburn Chapman (The Gap)	48 votes
Total	97 votes

One representative is required for each of these districts.

Homebush Sugar Levy.

The Homebush Sugar Mill Suppliers' Committee have been empowered to make a levy on sugar-cane growers in the locality constituted by the lands formerly assigned to the Homebush Mill but now assigned to the Farleigh Mill, and whose cane is diverted from the Farleigh Mill to North Eton, Marian, Pleystowe, Racecourse, or delivered to Farleigh, at the rate of one penny per ton on all cane delivered from the said locality to any of the abovementioned mills during the period 1st May, 1926, to 28th February, 1927. Provided, of course, that if at least seventy sugar producers in the abovenamed locality ask on or before the 22nd January, 1927, for a poll to be taken as to whether the levy shall be made, a poll shall be held, and if, upon the result of the poll, the majority of the votes is against the making of such levy, the levy shall not be made. The amount of the levy will be deducted by the managers of the mills concerned, from the final cane payments due by such mills to growers in the locality concerned, and the managers shall pay the amount deducted to the Homebush Sugar Mill Suppliers' Committee, which shall utilise same for the purpose of providing funds for the Homebush Mill Suppliers' Committee.

The American County Agent—An Australian's Impressions.

Much has been written about the American county agent, and the part he plays in "better farming" propaganda. In the course of a recent visit to the United States, Mr. D. Kelly, of Parkes district, New South Wales, collected some information and impressions which he has made available to the Advisory Council of the New South Wales Agricultural Bureau. Mr. Kelly's observations covered also the operations of the American Farm Bureau, and as the Bureau and the agent work together and are interdependent, they were made the subject of a conjoint report.

The method of organising the Farm Bureau of America, it is stated, is distinctly different from the New South Wales Agricultural Bureau system. The membership of a Farm Bureau would consist of subscribers scattered all over a county, who would contribute to the salary of the county agent, and would elect from their members an executive committee, or "county commissioners," as they are sometimes called. These executive bodies have very wide powers, including the right to levy direct taxes upon the farmers of the county to provide all necessary finance for the support of the county agent, &c. In this way a strong central body is created, which functions in a general way in all matters of interest to the agriculturists of the county; but in the opinion of Mr. Kelly is appears to lack the interest that centres in small local branches, which is so valuable a feature in the New South Wales system. An American State county would generally include an area of about 30 miles square. These are divided into square-mile sections or townships (as they are called), and with the Bureau indiscriminately spread over the whole area, the vital local interests, as stimulated by our own system, seemed to be lacking.

The visitor also found that there was in some localities a strong feeling of antagonism among certain sections of the farmers, who considered they were not getting any direct benefits from the organisation, and very bitterly resented having to contribute in direct taxes towards its upkeep. This feeling existed principally among the members of the Farmers' Union, a trading concern, running on co-operative lines.

The same remarks are stated to apply also to the county agent and his work:

"I came into personal contact with several county agents, and the general impression was that they were not very happy in their work. They appeared to attempt too many things in a general way, giving a great deal of time to the commercial problems of individual farmers, and marketing problems generally.

"While I was in one agent's office several men called in, inquiring for work on farms, and the agent told me that his time was mostly taken up with that kind of work during harvest time. The responsibility of collecting from the farmers subscriptions towards his salary rests upon the agent, and this circumstance very seriously depreciates both his status and his popularity in the community in which he has to work. In one State the county agent was vested with powers to take action in respect of the Noxious Weeds Act against landholders who disobeyed the law, and in this regard he was expected to perform police duties.

"Generally speaking, the county agent was looked upon as a kind of handy man —at the beck and call of everybody. If a farmer had a sick cow, or his fowls had refused to lay, he sent for the county agent; and woe betide him if things were not promptly rectified."

The conclusion arrived at was that development of the Agricultural Bureau and the district instructor system on existing lines seemed likely to prove most satisfactory to the agricultural interests of New South Wales.

American Fresh Fruits on the British Market.

That America is not free from the charge of sending damaged fruit to the British market so frequently levelled against Australia is shown by a report recently made by Mr. Edward Smith, Specialist in Foreign Marketing, employed by the United States Government. Writing on 23rd October, Mr. Smith said:—

"The week of September 30th witnessed the first appreciable arrivals of Washington Jonathans on the British market. Splendid prices resulted for Jonathans in good condition, but, strange to say, even at this early date, at least three cars of Washington Jonathans arrived showing internal breakdown and decay, with a general condition of over-ripeness. A portion of these were in this condition as a result of ordinary stowage on board ship, but two carloads, however, came under refrigeration, so that their over-ripe condition must have occurred prior to leaving New York. Most of these deteriorated Jonathans when sold showed a loss of at least 2s. per box, due to faulty handling practices.

"For several weeks Bartlett pears packed in barrels have been arriving in a deplorable condition—as only Bartlett pears can get in when over-ripe and decayed—selling for any price obtainable, if, in fact, the barrels did not have to be dumped."

Commodity Boards—Regulations.

Regulations to be known as "The Primary Producers' Commodity Boards Regulations of 1926-27" have been approved. These provide for the constitution of Commodity Boards, ballots in connection with Commodity Boards, election of members, meetings of Boards, &c.

The Cotton Board Constitution—An Alteration.

The constitution of the Cotton Board has been altered to provide for five representatives of growers instead of seven as originally provided. The members will now be elected biennially instead of annually, and it is provided that the present members shall hold office only until the election of new members, which will take place shortly. Nominations are being called for members, the date of closing being the 22nd January, 1927.

Broom Millet Levy.

The Broom Millet Board is empowered to make, on growers engaged in the broom millet industry, a levy at the rate of 2s. 6d. per cwt. (or part thereof if such part exceeds half cwt.) on all broom millet produced and sold during the period 1st December, 1926, to 30th November, 1927, such levy to provide for the administrative expenses of the Board. The amount of the levy shall be deducted from the proceeds of sales of broom millet by every agent, person, firm, &c., who purchases broom millet from a grower, or sells broom millet on behalf of a grower, and shall be forwarded to the Secretary, Broom Millet Board, by such agent, &c., not later than the seventh day of the month next succeeding such purchase or sale.

Novel Milk Can for Railway Transport.

A feature of the Annual Dairy Show, organised by the British Dairy Farmers' Association, and held in London in October, was the many new and improved dairying appliances. According to the "Farmer and Stockbreeder," one of the exhibits comprised "the special railway churn, built on Thermos flask lines, having double walls throughout, filled with insulating material." It was claimed that milk can be left in one of these churns all day in a hot sun, without more than 5 per cent. temperature rise. The name of the manufacturer is given as Mr. A. J. Clare, Wells, Somerset.

Present Position of World's Sugar Industry.

The world's production of sugar has increased by about 9,000,000 tons during the last seven years, and it is interesting to note that of this figure Europe accounted for nearly 5,000,000 tons, and Cuba for 1,150,000 tons. The consumption of sugar, however, throughout the world has not been able to overtake supplies, and at the end of the sugar year 1924-25 there was a carry-over of 2,890,000 tons. A large carry-over is also expected at the end of the year 1925-26. The question naturally arises as to whether production be restricted or the situation be left as it is, in the hope of arriving at some satisfactory basis with consumption overtaking production under the impetus of lower prices.

Discussing the matter in a recent supplement to the "Indian Trade Journal" (Calcutta), Mr. Kasanji D. Naik, M.A., and Mr. Dhirajlal M. Desai, B.Sc., of the Indian Sugar Bureau, point out that there is no doubt that India, Japan, and China are capable of absorbing much larger quantities of sugar, provided they are offered at a price which they can afford to pay. Assuming, however, that the normal increase in world absorption of 750,000 tons per annum will continue, it would mean that there are prospects of an increase in consumption at the end of ten years of 7,500,000 tons. Such an increase would only be possible provided large sums of money are invested in the industry. It must not be forgotten that Germany is still far short of its pre-war level of production, and that Russia can produce nearly a quarter million tons more than her output of the last campaign. The latest estimates place the area planted with beet in Europe at 2,182,000 hectares or 5,394,700 acres—an increase of 48,560 hectares or 120,000 acres over last year.

The problem is how and in what way production may be reduced and the consumption increased. The price generally paid for the commodity is the determining factor. Any appreciable rise in prices would act as a check on consumption; on the other hand, if the prices were to go lower than the present level it would not pay the factory to manufacture sugar, the cost of production having increased considerably since the war. This brings about unsettled conditions in the market with consequent fluctuations which benefit only the speculators, but are in reality detrimental to the trade as a whole.—"Chamber of Commerce Journal," London.

Activities of the New Zealand Honey Control Board.

According to a report issued by the New Zealand Honey Control Board the system of organised marketing of honey which has voluntarily been followed has achieved considerable success. This has been brought about in the specialising of New Zealand honey, first by packing only a definite standard of quality, second by retaining its identity in its retail distribution, third by keeping below-standard from table consumption, and fourth by extensive advertisng and publicity work. This system of marketing, according to the report, has resulted in New Zealand honeys being sold at a considerable premium over competitive honeys, a portion of such premium, in the ordinary course of events, being absorbed in the payment of advertising and distribution costs. The Control Board was set up to have this system of marketing protected, the disorganisation of which could otherwise be brought about by shippers selling outside the organisation.

The Honey Control Board first assumed control in February, 1925, this control requiring that all honey exported to the United Kingdom and Europe should be shipped to and distributed by one agent only. The Control Board does not handle accounts, the shipper dealing direct with the agent. The costs of maintaining and extending the market are distributed over all consignments to the extent that advertising charges are spread equally over all sales, the expenditure of one year being spread over the sales in that period, and also the costs of distribution, and control of distribution in the 5 per cent. commission allowed to the agents. Exporters are financed as required by advances made by the agents' New Zealand representative against documents.

Limited control has operated over the 1925 and 1926 export seasons. The producers who were exporting through their own association were in no wise affected when control came into operation, they having borne the costs of organised marketing throughout. The number of shippers, therefore, affected by control is very few. In 1925 they represented 2.8 per cent. of the producers exporting, their honey representing 4.6 per cent. of the whole. In 1926 the figures were 1.89 per cent. and 2.19 per cent. respectively.

Previous to organised marketing, New Zealand honey did not realise equal to Californian or Jamaican, but, in August last, sales of New Zealand honey were made at from 60s. to 80s. per cwt. Quotations for the same month for Canadian honey were at 40s. to 56s. per cwt., Californian at 47s. to 58s., and Jamaican 42s. to 49s. The report points out, however, that while a considerable portion of the premium obtained has been absorbed by advertising charges, the balance represents a considerable margin on the returns of New Zealand's competitors. The total exports for 1925 amounted to 785 tons, some 265 tons more than for 1924. The export for 1926 was 550 tons, the reduction being due to an adverse season.

Business with Germany is developing satisfactorily. During the period July to November, 54 tons were sold to that country, all in retail packages. This progress in the introduction of New Zealand honey into Europe has been made despite the fact that it pays a duty of roughly 20s. per cwt.

It is now proposed that the board investigate the marketing conditions with a view to ascertaining whether costs of marketing can be reduced while at the same time retaining a proportionate amount of the advantages gained and also provide for the disposal of the increasing production.

Cheap Rugs for Dairy Cows.

To farmers who favour the rugging of their dairy cows, but who cannot afford the ordinary bought article, the following suggestion of a dairy instructor of the New South Wales Department of Agriculture will be of interest:—

"The farmer can make his own cow rugs for little more than the cost of the bags, a ball of twine, and a sewing needle, plus his own ingenuity. Two bags (cornsacks or any heavy bags will do), or three for larger cows, will make a nice rug. Split them down the seams and join together, place on the cow, and sew together in front of the cow's brisket; next join the back with a 4-inch strip of bag about 12 or 18 inches below the rump-level, and the rug is complete.

"This home-made rug will keep the cow warm, and after a few days' wear, when the oil, &c., from the cow's body has soaked into the rug, it will also be waterproof. The rug can quite easily be slipped off and on over the cow's head. The cow's name painted on the rug over the rump with tar prevents confusion in replacing the rugs."

It is stated that it is fairly common on the North Coast of New South Wales to see a herd rugged during portion of the winter in the manner described. The practice helps greatly in the maintenance of the milk flow, and the idea is one that should appeal to all thrifty dairymen.

Arrowroot Levy.

The Arrowroot Board has been empowered to make, on all growers delivering arrowroot bulbs to mills during the 1926-27 season a levy at the rate of 1d. per ton of bulbs so delivered. The amount of such levy shall be deducted by the managers of mills concerned from payments due by such mills to growers, and shall be paid by the managers to the secretary of the Arrowroot Board at the end of 1926-27 season. The proceeds of the levy shall be utilised for the administrative expenses of the Arrowroot Board.

The Marketing of Poultry in England and Wales.

At an approximate estimate, about 75 per cent. of the total poultry marketed in England and Wales is produced there, but there is reason to believe that the overseas producer has not yet delivered his main offensive, states the Report on the Marketing of Poultry in England and Wales just issued by the British Ministry of Agriculture, which, though prepared primarily for the information of the home producer, will nevertheless be of great interest to Australian producers. The report shows that there are many directions in which reform is desirable; there is little or no specialisation in the production of a particular type of bird to meet specific market demand as there is in France, Holland, and Belgium; there is no uniform system for the classification and grading of home produce. This last is a pressing need. A scheme of classification and grading applicable to both live and dressed poultry is, therefore, put forward in the report for consideration. The scheme has met with the approval of leading distributors in the trade who realise that "the present lack of uniform terminology, of a standard system of price quotation and of well-defined quality distinctions that are accepted and understood generally, leads too frequently to a state of affairs on the wholesale markets that is little short of chaotic."

In other respects, the preparation of home-produced poultry for market is poor, and there is a general lack of knowledge of market requirements. An important section of the report is, therefore, devoted to describing the best practices at home and abroad. These include the processes of conditioning, fattening, killing, plucking, cooling, shaping, and trussing. Stress is laid in the report on the importance of the systematic conditioning of birds for varying periods before slaughter. At present this is not carried out to any great extent in England except at one or two centres, and complaints are general in the wholesale markets of the high proportion of lean and unfinished birds received. Conditioning should play an increasingly important part in the future course of the industry. For various reasons, individual producers, particularly general farmers, are rarely in a position to carry out the process conveniently or economically, and the report states that it can usually be best left to country wholesalers or to conditioning and packing establishments run by producers on co-operative lines.

With the aid of the grant recently made to the British Ministry of Agriculture by the Empire Marketing Board, the report is being issued at a very low price. It can be obtained from His Majesty's Stationery Office, London, for 9d., post free.

Regularity in Cow Feeding.

Experiments by the United States Department of Agriculture at the experimental farm of the Bureau of Dairying show that with cows that are average to good, milking may take place at irregular hours without any marked effect upon production. Whether very high producers would show similar results has not been determined.

It was found, however, that when irregular milking was accompanied by irregular feeding the production was lessened about 5 per cent. Apparently cows are more sensitive to changes in the feeding routine than to variations in the hours of milking. The conclusion is not to be drawn from these experiments that regularity in doing the dairy work is a matter of little importance, observes the Department, but rather that cows can occasionally be milked earlier or later than usual if there is something else to which the dairyman desires to give his time.

Though it is generally believed that a cow will produce more when milked always by the same person, the practice in many large dairies in the United States, where there are several milkers, is to milk the cows as they come, rather than to reserve certain cows for each man. At the Bureau's experimental farm, twelve cows were divided into three groups of four cows each, and each group was milked regularly by the same man for forty days. The twelve cows were then milked by the same three men in such a way that no cow was milked twice in succession by the same man. After forty days the cows were changed to regular milking again for forty days. The results show an increase of only about 0.05 per cent. in the milk and butter-fat through steady milking by the same man. This, says the Department, is so little as to be almost negligible.

Farm for First Offenders.

The Government of South Australia is considering a proposal of the Salvation Army to establish a farm for absorbing first offenders, following a suggestion of the Justices' Association. The suggestion is that the Salvation Army should manage the farm and that the Government should finance it. When an arrested man is unemployed and destitute, it is proposed that the magistrate should have a discretion to order a period on the farm instead of imprisonment.

The Value of Crop Rotation and Fertilisation in Increasing Soil Productivity

According to the Bureau of Soils of the United States Department of Agriculture, the United States will have to depend upon the cultivation of the soil for about one-third of its combined wheat, maize, and oats produced; upon crop rotation for another third; and upon the use of manures and commercial fertilisers for the other third. It is logical, states the Bureau, that cultivation aids both rotation and fertilisation, that rotation aids in rendering fertilisers more effective, and that fertilisers increase the value of rotation. Recent experiments, however, bring out the fact that rotation and the use of fertilisers, when practised together, may interact to the extent that their conjoint effects, as measured in terms of crop increases, may be not only equal to but greater than the sum of their separate effects.

The average yield of maize obtained without fertilisers and rotation in these particular experiments was 23.4 bushels per acre. The gain due to using fertilisers and lime was 9.2 bushels per acre, and the gain due to rotation alone was 27.8 bushels, or practically three times that obtained from the fertilisers and lime. The total increase effected by conjoining rotation and the use of fertilisers was 44.2 bushels per acre, or 7.2 bushels greater than the sum of their separate increases.

Other experiments conducted by the Bureau have corroborated these results, which emphasise the importance of recognising all three factors in striving for permanent soil productivity.

Readers are reminded that a cross in the prescribed square on the first page of this "Journal" is an indication that their Subscription —one shilling—for the current year is now due. The "Journal" is free to farmers and the shilling is merely to cover the cost of postage for twelve months. If your copy is marked with a cross please renew your registration now. Fill in the order form on another page of this issue and mail it immediately, with postage stamps or postal note for one shilling, to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Buds and Grafts—Directions for their After Care.

Shoots that were budded the previous growing period should have been cut back to start the inserted buds into growth when the natural buds of the stock showed signs of activity in the spring. It is generally far better that this cut should be made between 2 and 3 in. above the inserted bud, leaving a stub to which the tender shoot from the inserted bud can be tied as it extends, thus lessening the chances of breakage from wind. Apart from tying, the projecting stub often offers protection to the tender shoots from birds resting or the brushing of persons or horses when passing.

The buds on the stub above the inserted bud will start into growth, and if not attended to will probably sap the growth from the inserted bud. The way of dealing with these buds which entails the least work is to destroy them by picking them out with the thumbnail or secateurs when cutting back the shoots in the spring, and if one cannot depend on finding time to pay attention to the buds later probably this is the best plan. However, the inserted buds appear to come away with a healthier growth if the buds in the stub above are allowed to start. When this is done it is necessary to pinch the growth from them later to prevent the growth from the inserted bud being sapped. The healthier growth from the inserted bud is probably due to the buds above drawing the sap and later providing

foliage which assists in elaborating the raw sap. After the growth from the inserted bud has grown out a few inches and has an established appearance, the growths from the stub above can be brushed off to avoid further attention.

Growths Below the Inserted Buds.

Besides the growth from the buds on the stubs, many growths will start from the stock below the inserted buds, or from below grafts that have been inserted earlier in the spring of the current season. On nursery stocks these growths are generally better rubbed off on sight, but on established trees that have been worked over with another variety it is far better to allow some of the growths from below the inserted buds or grafts to remain. However, attention is required, or these growths may sap the growths from the buds or grafts.

Some of the shoots from below the buds or grafts will at once show great vigour, and are better rubbed off at once, as they will be a constant menace; the weaker shoots are better allowed to remain, but should be inspected occasionally, and, if any shoot strongly, should be pinched or slashed back to prevent them sapping the growth from the inserted buds or grafts.

The advantages of leaving some growth on the stumps of worked-over trees below the buds or grafts is threefold. In the first place these growths provide some foliage to assist in the elaboration of the raw sap. It must be remembered that by cutting back the main limbs for grafting or budding the major part of the foliage is lost, and the roots thereby suffer partial starvation till sufficient growth is made to restore the balance between root and top. Secondly, the growth on the stumps shades the bark from the sun and promotes sap circulation, which prevents the sun from scalding the bark. Thirdly, the extra growth assists in protecting the tender new shoots from the inserted buds or grafts from breakages by wind.

Sometimes when working over established trees some limbs are left unworked; where this has been done it is often necessary to check their growth during the following growing season, or they will sap the growth from the buds or grafts too much.

The shoots from the inserted bud or graft should be interfered with as little as possible during the growing season, but when they make rapid growth it is necessary to pinch them back to prevent them being blown out by winds. For a year or two after they start they must also be cut back rather severely when pruning in the winter to prevent too rapid extension till they are fairly established.

Superfluous Inserted Buds.

Superfluous inserted buds should not be removed for the first two or three years till those selected for framing the tree are well established, and there is reasonable certainty that they will not be blown out or lost by other mishaps. Likewise the superfluous scions on a stump should be retained till the callous has spread well over, and all round the cut edge of the stump. If only one scion is left on a thick stump the sap will not be drawn on the opposite side, and the bark will often die away on that side. The extra scions round the stump keep the sap moving on all sides and hasten the callousing over of the wound.

Though the delay in cutting them out often creates a fairly big wound when the time comes for the operation to be performed, such wounds are surrounded by the new callous, and the liberal flow of sap causes them to heal over rapidly. As the growth from buds or grafts on reworked established trees often develops very rapidly, there is danger during the first few years, until the callous has crept round, of their being broken out. For this reason it is wise to brace the new limbs with lashing or wires.—A. and P. Notes, N.S.W. Department of Agriculture.

Agriculture in Germany.

According to an American official report, unbalanced economic conditions in South-west Germany have led to an agricultural situation under which farmers, in many instances, are unable to make a living. The result has been a large emigration of farmers limited only by the immigration restrictions of various countries. In 1871 the rural population of Germany was 64 per cent. of the whole population, while the present percentage is said to be only 35.

Laying Out a Poultry Farm.

The shape of the block, the area available, the aspect and the general direction of the fall, all require close attention, both before purchase and subsequently when deciding on the location of poultry farm buildings and yard.

The best site for a poultry farm, other things being equal, is a slope with a north-eastern aspect, free from broken ground or rocky declivities, and having a clear opening for the morning sun to reach the yards. Flats and hollows are not suitable positions, especially when the ground is of a clayey nature; high positions give decidedly the best results in winter egg production. It is a truism that poor land keeps the farmer poor, and this, together with position, is in a great measure applicable to the site for a poultry farm; it will take some very substantial advantages in other directions to balance the handicap of a bad site. According to its size, too, every poultry farm should have its cultivation area, for the purpose of growing at least all necessary green feed.

Following are some points in the selection of a site:—

A northern or north-eastern aspect is best.

Give preference to high ground with a gentle slope, not too much exposed to south-west winds.

Secure good surface drainage, and avoid seepage at the foot of hills.

Give preference to sandy soils as against those of clay formation.

Avoid flats and gullies.

Rocky positions will be found troublesome in the matter of erecting fences and laying out the farm generally.

Give preference to land in its virgin state over that which has been cultivated.

Remember that adequate provision of water is a very important factor.

It is highly desirable that the land should have sufficient fall to allow of good surface drainage; without this, adequate sanitation is impossible. Where there is a good fall in the land the yards will get washed during heavy rains, which is very desirable, particularly on clay or loamy soils, but it is a mistake to have too steep a gradient. On sandy soils of good depth perhaps this is not so important, because sand is such a good filtering agent; but the great bulk of poultry farming is conducted on the soils of the class first mentioned.

The buildings, too, will have to be arranged so that they will not too materially obstruct the natural course of the water; it is also most important that the yards or enclosures fall away from the houses, not towards them. If placed otherwise, trouble will certainly be experienced with water running into the houses during rainstorms.

The area of land required will, of course, be in proportion to the anticipated extent of the operations. Of late there have been systems claiming to be able to run so many thousands of poultry to the acre, but an ultimate breakdown is almost a certainty with such intensive methods. It may be set down that if one is to make a living on the average country taken up for poultry farming, 5 acres is the minimum that can be advised. On this area it is possible to run 800 to 1,000 layers, to raise the necessary stock to maintain that number, and to have a small area on which to grow green feed.

The poultry industry can only become fully profitable when established on sound lines, and when each stage, from the selection of the breeding stock to the final marketing of either egg or live bird, receives the closest consideration.—"A. and P. Notes," N.S.W. Dept. Ag. and Stock.

Burn—or Plough in?—A Point in Preparing Land for Wheat.

One of the questions most frequently asked in relation to the preparation of land for wheat is: "Would it not be advisable to occasionally plough in the straw left after harvesting, instead of burning it?" It can be definitely stated that it is always advisable to burn the stubble. A good stubble burn is one of the best means of destroying fungus spores, and is therefore of great assistance in combating such diseases as flag smut, take-all, wheat blight, and wheat mildew.

The ploughing in of stubble, in addition to encouraging fungus diseases, also has a most objectionable effect on the physical condition of the soil, rendering it extremely difficult, if not impossible, to bring about a good consolidation of the sub-surface soil. The moisture-holding capacity of the soil is also affected temporarily.

The results of experiments carried out in wheat districts throughout New South Wales indicate that wheat yields are reduced when the straw is ploughed in. This reduction in yield has in the past been chiefly attributed to the detrimental effect of

the straw on the physical condition of the soil, but in view of the results of recent investigations in the United States of America it now seems that there is also a detrimental effect on the nitrogen content of the soil. The investigations referred to showed that—

(1) The ration of nitrogen to carbon in soils, irrespective of their origin, is practically constant, and tends to remain so. Taking the carbon content as an index of the organic matter present in the soil, this indicates that the soil organic matter cannot be increased unless additional nitrogen has also been provided.

(2) The nitrogen-carbon ratio in material returned to the soil has a marked influence on the kind and rate of decomposition. Organic matter, such as wheaten straw, having a wide nitrogen-carbon ratio (1 part nitrogen to 75 parts carbon) has a depressing effect on the development of nitrates when applied to the soil, and such effect is noticeable until there has been sufficient decomposition to cause the ratio to approach that of the organic matter of the soil. Green manure of a leguminous nature would have a narrow nitrogen-carbon ratio (1-10). If this were ploughed in there would be an immediate and rapid nitrate development. There would also be less loss of carbon-dioxide, and an indication of greater maintenance of organic content.

The application of straw to the soil stimulates the activities of bacteria, which use the straw as a source of carbon and the nitrates of the soil as a source of nitrogen. The nitrates are transformed into organic nitrogenous material, and for the time being are lost to the soil, as far as their availability is concerned. The more straw ploughed in, the greater the loss of nitrates. Nearly all the carbon is lost as carbon-dioxide, and as this is the case non-leguminous crop residues, such as wheaten straw, cannot bring about any satisfactory increase in the amount of humus in the soil.

In the light of these results it now appears that, although straw is ploughed in with the idea of increasing the humus content of the soil, actually it would be no better in this respect than if the straw had been burnt, and would even result in a temporary loss of available nitrogen. From every point of view, therefore, the burning of wheaten or oaten straw is preferable to ploughing it in.

In view of these investigations it would also appear advisable to eat off such green stuff as wild oats, self-grown wheat, &c., rather than to plough it in, as the sheep would return most of the green stuff to the soil in a handier form. Much nitrogen also would be returned in the excretion. To increase the humus content of the soil to any extent we must also increase the nitrogen content. This can best be done by ploughing in or feeding off a leguminous crop.

There is great difficulty in finding a leguminous crop that can be economically fitted into the present system of wheat-growing. Although field peas grow well throughout most of the Southern wheat belt, they have not up to the present been widely grown. The reasons for this are: (1) Sheep do not eat them as readily as could be desired; (2) the expense of seeding; and (3) the difficulty of each year economically feeding off a large area of field peas. In the future, as sheep become more closely associated with the growing of wheat, and as the areas become smaller, this problem of utilising green crops will tend to solve itself, but at present it is a serious drawback to the growing of leguminous crops.

Rotation experiments are being conducted at the experiment farms on this important matter, and the result should eventually be most valuable.—"Agricultural and Pastoral Notes," New South Wales.

When Buying a Cream Separator.

Although the proper handling and care of the cream separator is becoming more generally known, writes Mr. E. O. Challis, Superintendent of Dairying, South African Department of Agriculture, a large number of cream suppliers have still much to learn in this respect. Its proper understanding is important, especially in view of the fact that the variations in cream tests depend almost entirely on whether the separator is being worked correctly or not. There are many excellent makes of separators on the market, as well as numerous bad ones. In selecting a machine one that is simple and solidly constructed should be chosen, which is easy to clean and turn, has a minimum of spare parts to be replaced, and, above all, skims clean.

A cheap separator is dear at any price. It wears out quickly, frequently requires new parts, and, after a comparatively short time, will cause no end of trouble between the creamery management and the supplier owing to the variations from day to day in the consistency of the cream.

To ensure good work being performed by any separator, it is essential to have it firmly set up on a solid foundation, care being taken to ensure that the latter is perfectly level. These points are too frequently neglected, with the result that the

machine quickly gets out of order, and clean skimming becomes almost impossible. In selecting a foundation for a machine, it should be borne in mind that the types which have a suspended bowl can be placed directly on a cement floor, a cement block, or solid stone foundation. Machines not having the suspended type of bowl can be similarly fixed, but must have a wooden cushion inserted between the base of the machine and the solid block foundation. This latter precaution is very necessary, as good types of machines frequently go wrong owing to having been bolted down direct on either a stone or concrete base.

Growing Green Peas—Climatic and Soil Requirements.

It is not many years since green peas were looked upon as a luxury, but now this vegetable is classed with those of almost everyday use, as it is possible to secure supplies practically throughout the year at prices within the reach of all.

The pea crop requires for its best development a temperate climate. In the cooler portions of the State the season of growth is during the summer months, a period when the cultivation of the crop is limited in other districts owing to the heat. While the plant itself is seldom injured by frost, the flowers and pods are not so hardy. Young pods that have been frosted and that are unlikely to develop may be distinguished by a characteristic white, mottled appearance on the outside skin. During autumn and spring, when frosts are sufficiently severe to cause damage to the crop in cool, elevated districts, the conditions are suitable for its growth in warmer districts, while in the frost-free regions bordering on the sea the crop can be harvested in midwinter.

Experience of local conditions and luck in missing damaging frosts at flowering time are the factors which largely regulate the range in planting dates from the early to the late sown crop.

The damage from frost may be only partial, and a later crop of bloom on plants previously "nipped" may form up without further trouble in this respect.

There has been a considerable increase in the area planted of late years, so much so that gluts are not infrequent. This is due largely to the high monetary returns which are at times secured during crop shortages inducing greater interest in the crop in following years. It is always impossible to foretell what the season will be, and as the crop is one largely grown without irrigation fluctuations will always occur.

During periods of glut many consignments realise less than the picking and forwarding costs, and are then a direct loss to the growers. Under these circumstances it would be advisable for growers to consider the question of maturing the crop for seed. If this were done a good deal of expense of future crops would be saved, and, apart from supplying one's own requirements, there should be little difficulty in disposing of further supplies should the quality be satisfactory.

As the supply of pea seed is now almost wholly imported, it is in the interests of the State and producers generally that greater attention be given to this aspect of the pea-growing industry. The possibilities in this direction should certainly not be lost sight of during periods of glut.

A sandy loam is most suitable for the crop, but almost any soil of fair average quality will yield good results. As with all legumes, the supply of nitrogen in the soil is a matter of less moment than that of phosphoric acid, potash, and lime, and hence it is that in some localities dressings of fertilisers that contain the last three have a material effect upon the yield. The crop has the strong recommendation that in addition to yielding profitably it contributes to the fertility of the soil for the purpose of subsequent crops by increasing the store of nitrogen, and by enabling the gardener or farmer to add to the soil a considerable quantity of top-growth of a kind that humifies readily when turned under.

It does well on newly-broken land, and can be used as a preparation crop.—"Agricultural and Pastoral Notes," New South Wales.

DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.

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Queensland Flora (Bailey), 6 vols., 30s.
Temperate Fruits of Queensland, 2s.

Please address all requests for copies of these publications to the Under Secretary, Department of Agriculture and Stock, Brisbane.—John Reid, Editor of Publications.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

1927.	JANUARY.		FEBRUARY.		MOONRISE. Jan.	Feb.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5.1	6.49	5.26	6.46	2.33	3.44
2	5.2	6.49	5.26	6.45	3.17	4.48
3	5.3	6.49	5.27	6.45	4.6	5.57
4	5.3	6.50	5.28	6.44	5.2	7.5
5	5.4	6.50	5.28	6.44	6.4	8.13
6	5.5	6.50	5.29	6.43	7.9	9.17
7	5.6	6.51	5.30	6.42	8.16	10.22
8	5.6	6.51	5.31	6.42	9.21	11.24
					p.m.	p.m.
9	5.7	6.51	5.31	6.41	10.25	12 25
10	5.8	6.51	5.32	6.40	11.27	1.27
					p.m.	
11	5.9	6.51	5.33	6.40	12.29	2.27
12	5.9	6.51	5.34	6.39	1.31	3.25
13	5.10	6.51	5.34	6.38	2.31	4.19
14	5.11	6.51	5.35	6.37	3.34	5.1
15	5.12	6.51	5.36	6.37	4.31	5.54
16	5.13	6.51	5.36	6.36	5.30	6.34
17	5.13	6.51	5.37	6.35	6.22	7.11
18	5.14	6.51	5.38	6.34	7.0	7.45
19	5.15	6.51	5.38	6.34	7.58	8.10
20	5.16	6.50	5.39	6.33	8.35	8.46
21	5.16	6.50	5.40	6.32	9.11	9.15
22	5.17	6.50	5.40	6.31	9.45	9.49
23	5.18	6.49	5.41	6.30	10.15	10.22
24	5.19	6.49	5.42	6.29	10.46	11.1
25	5.19	6.49	5.42	6.28	11.16	11.42
26	5.20	6.48	5.43	6.27	11.50	nil
						a.m.
27	5.21	6.48	5.44	6.26	nil	12.31
					a.m.	
28	5.22	6.48	5.44	6.25	12.25	1.25
29	5.23	6.47	...	...	1.0	...
30	5.24	6.47	...	...	1.53	...
31	5.25	6.47	...	...	2.45	...

Phases of the Moon, Eclipse, Occultations, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania.

4 January	● New Moon	6	27 a.m.
11 ,,	☾ First Quarter	12	43 a.m.
18 ,,	○ Full Moon	8	26 a.m.
26 ,,	☽ Last Quarter	12	5 p.m.

Perigee, 7th January, 1 6 p.m.
Apogee, 23rd January, 1 18 p.m.

When the Sun rises on 4th January it will be under circumstances quite unusual. Instead of the full-orbed Sun the greater part of its face will be darkened by the intervening Moon and only about one-fifth of the usual brilliant orb will bring modified daylight at Warwick and Toowoomba. Right across the Pacific Ocean and part of South America the magnificent phenomenon of an annular or ring-shaped eclipse of the Sun will occur.

The fact that the Earth and Moon will be in Perihelion at the time of the Eclipse is the principal reason why an annular instead of a total eclipse will result.

An occultation of Epsilon Tauri, a small star of magnitude 3·6, will take place about 40 minutes after midnight. The star will disappear before the bright edge of the Moon reaches it, the cause being the dark or unlit portion of the Moon preceding the brightened surface.

Mercury will be in superior conjunction with the Sun on the 28th, that is on the path of its orbit beyond the Sun and farthest from the Earth. Mercury will not be directly behind the Sun but two degrees, or four times the diameter of the Moon above it.

2 February	● New Moon	6	54 p.m.
9 ,,	☾ First Quarter	9	53 a.m.
17 ,,	○ Full Moon	2	18 a.m.
25 ,,	☽ Last Quarter	6	42 a.m.

Perigee, 4th February, 10 6 a.m.
Apogee, 20th February, 4 6 a.m.

By the middle of February Jupiter and Mercury will set so soon after the Sun as to be unobservable. Venus also will be low down near the western horizon.

Jupiter and Mercury will be in conjunction on the 13th, at 10 p.m., about three hours after they have set.

The most distant planet, Neptune, will be opposite the Sun on the 15th. Owing to its great distance from the Earth, it is only a small telescopic object. On the 16th it will be in conjunction with the Moon at 9 p.m., when it will be eight times the diameter of the Moon above it and, apparently, in the constellation Leo.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.